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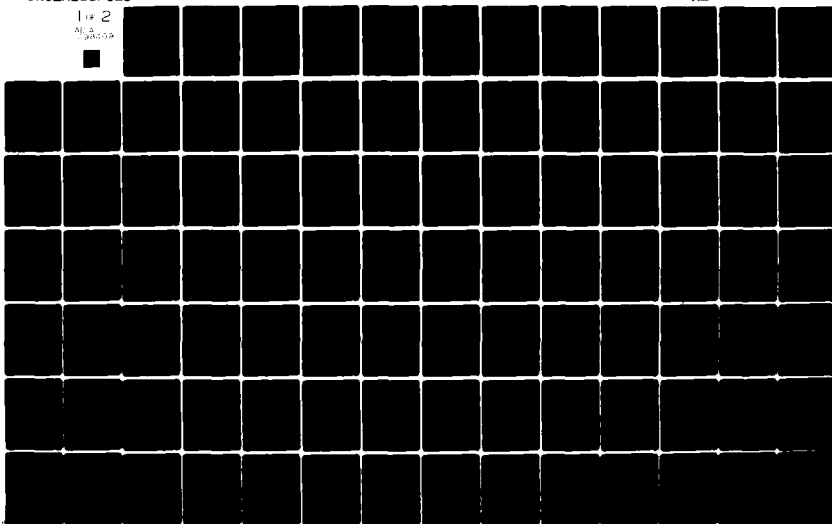
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SURVEILLANCE REPORT. STAGE I DISSECTED MOTORS. PHASE XII. PROPE--ETC(U)
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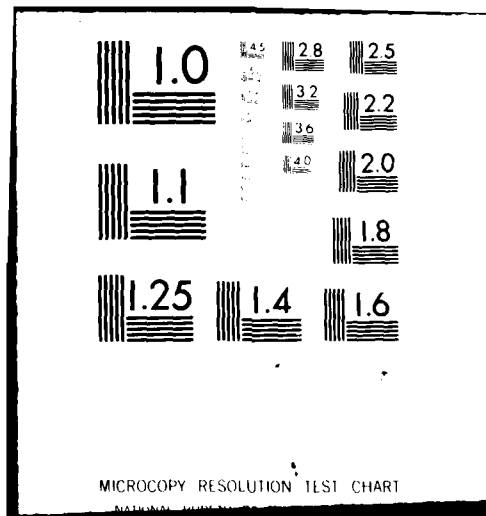
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HEADQUARTERS

OGDEN AIR LOGISTICS CENTER

UNITED STATES AIR FORCE

HILL AIR FORCE BASE, UTAH 84056

AD A098409

(6) SURVEILLANCE REPORT.

STAGE I
DISSECTED MOTORS.
PHASE XII.

PROPELLANT AND COMPONENT TESTING.

PROPELLANT ANALYSIS LABORATORY

MAKPH REPORT NR
-452(81)

JANUARY 1981

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MMWRM PROJECT M82934C

SURVEILLANCE REPORT

STAGE I DISSECTED MOTORS

PHASE XII PROPELLANT & COMPONENT TESTING

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January 1981

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ABSTRACT

Testing was performed to determine the useful shelf/service life for LGM-30 Stage I Rocket Motors. A three year storage program for propellant and components was started in May 1961. This program was then extended to a ten year study and later continued indefinitely to assure that a deterioration in motor physical characteristics could be detected in time to take some corrective actions before the weapon system performance deteriorated below an acceptable level.

This report covers only propellant data and limited case bond data. The malfunction of an environmental chamber destroyed component samples that had originally been part of this testing program (and the inadvertent burning of some motors during dissection reduced the material available for testing). Planned dissection of selected motors in the future will provide samples for continued component testing. Test specimens for this reporting period were obtained from motors STM-012, 0012099, and 0012199. UP-7775 block propellant was not tested since that propellant has been used up.

A new technique of Multi-symbol Regression Analysis was used to determine aging trends. Also, using a unique plotting code for each motor tested demonstrates the relationship between motors and block propellant. The plotting symbols for each motor and block propellant are listed in the statistical analyses section.

The data from this test period was combined with data from previous testing and entered into the G085 computer for storage, analysis, and regression analysis. From the statistical analysis of all data tested to date, significant degradation of the propellant does not appear likely for at least two years past the oldest data point.

Future testing will be conducted on dissected motors.

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GLOSSARY OF TERMS AND ABBREVIATIONS

| | |
|---------------------|--|
| Aging Trend | A change in properties or performance resulting from aging of material or component |
| CSA | Cross Sectional Area |
| DB | Dogbone |
| Degradation | Gradual deterioration of properties or performance |
| E | Modulus (psi), defined as stress divided by strain along the initial linear portion of the curve. |
| EB | End Bonded |
| EGL | Effective Gage Length |
| em | Strain at maximum stress |
| er | Strain at rupture |
| "F" ratio | The ratio of the variance accounted for by the regression function to the random unexplained variance. The regression function having the most significant "F" ratio is used for plotting data. The ratio is also used in detecting significant changes in random variation between succeeding time points |
| JANNAF | Joint Army, Navy, NASA, Air Force Committee |
| MAKPH | Propellant Lab Section at Ogden Air Logistics Center |
| Ogden ALC | Ogden Air Logistics Center, Air Force Logistics Command |
| r or R | The Correlation Coefficient is a measure of the degree of closeness of the linear relationship between two variables |
| Regression Equation | The general form of the regression equation is $Y = a + bx$ |
| Regression Line | Line representing mean test values with respect to time |
| S_b | Standard error of estimate of the regression coefficient |

GLOSSARY OF TERMS AND ABBREVIATIONS (cont)

| | |
|------------------------------|--|
| S_e or $S_{y.x}$ | Standard deviation of the data about the regression line |
| S_m | Maximum Stress |
| S_r | Stress at rupture |
| Standard Deviation (S_y) | Square root of variance |
| Strain Rate | Crosshead speed divided by the EGL |
| "t" test | A statistical test used to detect significant differences between a measured parameter and an expected value of the parameter (determines if regression slope differs from zero at the 95% confidence level) |
| Variance | The sum of squares of deviations of the test results from the mean of the series after division by one less than the total number of test results |
| 3 Sigma Band | The area between the upper and lower 3 sigma limit. It can be expected that 99.73% of the inventory represented by the test samples would fall within this range assuming that the population is normally distributed. |
| 90-90 Band | It can be stated with 90% confidence that 90% of the inventory represented by the test samples would fall within this range assuming that the population is normally distributed |

INTRODUCTION

A. PURPOSE:

This report contains test data from samples of LGM-30 Stage I, Wings I-V TP-H1011 propellant and case bond specimens. Testing was performed by the Propellant Laboratory Section (MAKPH) for the Engineering and Reliability Branch of the Airmunitions Management Division (MMWRBM) under Project M82934C-WNL17514. This report is the twelfth in this series. Data from this test period and propellant test data from the eleven previous reports were entered into the GO85 computer for regression analysis. The regressions are shown in this report.

B. TEST PROGRAM:

The LGM-30 Laboratory and Component Program includes the testing of materials used in the main case and main grain propellant. This report covers TP-H1011 propellant and case bond specimens. Table I outlines the test program.

Propellant for testing was obtained from three dissected motors; STM-012, a motor prepared by Thiokol specifically for dissection; S/N 0012099, a SLIM motor and S/N 0012199 which was selected for dissection. UP-7775 block propellant which had been tested during previous test periods was not tested at this test period as it was used up during the last test period.

C. HISTORICAL BACKGROUND:

In May 1961, Thiokol began a three year LGM-30 laboratory storage and test program to determine the rate of degradation with age for Stage I materials. During June 1962 and again in August 1963, additional samples were included. New samples were added in July and August 1964 when the

surveillance testing program was extended to ten years (Test Plan 0717-62-0967, 53-8). Carton block propellant, batch UP-7775, containing TP-H1011 propellant cast in March 1962 was added to the program in 1964.

Samples added to the inventory in 1964 were considered to be a new population, but were combined in regression analysis with the three dissected motors. The history of testing of these materials is found in MQQP Report Nrs. 109A(67), 144(68), 208(71), and MANCP Report 358(76). Physical transfer of the specimens from Thiokol to Ogden ALC was made in June 1967.

TABLE I
TEST PROGRAM

All Temperatures in Fahrenheit
Motors STM-012, S/N 0012099, S/N 0012199

(Block Propellant UP-7775 was included in this portion
of the test program in previous test periods)

| <u>Test</u> | <u>Conditions</u> | <u>Spec/Cond</u> | <u>Spec Config</u> |
|----------------------|--|------------------|-----------------------|
| Tensile | 77°, 2.0 & 20 in/min | 5 ea | JANNAF Dogbone |
| Creep | 77°, 10 & 12 lb load | 3 ea | JANNAF Dogbone |
| Stress Relax | 77°, 3 & 5% strains | 3 ea | 1/2" x 1/2" x 4" |
| Strain Dilatation | 77°, .25 in/ in/min | 3 ea | 1/2" x 1/2" x 4" |
| Hardness | 77°, initial & 10 seconds | 5 ea | Dogbone Ends |
| HOE | 77° | 3 ea | 1/2' x 3/8" x 1" |
| Burning Rate | 77°, 500 & 1000 psi | 5 ea | .156" x .156" x 5" |
| DTA | 77° start | 3 ea | 0.040" wafer |
| Ignitability | 77°, 168 cal/ cm ² - sec | 3 ea | 0.050" wafer |
| Sol Gel | 77° | 6 ea | 1/2" x 1/2" x 1/2" |

UP-7775 was NOT included in this portion of the test program
in previous test periods.

| | | | |
|----------------------------|----------------------------------|------|------------------------------|
| High Rate Tensile | 77°, 1000 in/in/min | 5 ea | 3/4" GL Dogbone |
| High Rate Triaxial Ten | 77°, 1000 in/in/ min, 600 psi | 3 ea | 3/4" GL Rail |
| Dynamic Response | 77°, 70 gm ct. wt. | 3 ea | 3.3" x 3.3" x 0.690" disc |
| Biaxial Constant Strain | 77° | 3 ea | 3/4" GL Rail |

TABLE I (cont)

| <u>Test</u> | <u>Conditions</u> | <u>Spec/Cond</u> | <u>Spec Config</u> |
|---------------------|--|------------------|--------------------|
| Failure Envelope | Temp: -50° , -20° , 10° , 40° , 77° , 130° & 180°F at a rate of 0.2, 2.0 & 20 in/min | 3 ea | JANNAF Dogbone |

STM-012 and S/N 0012199 only were used for the following tests:

| | | | |
|---|--|---------------------|-----------------------|
| Case Bond Tensile | 77° , 0.2 in/min | 10 ea | 1" x 5/8" x 3/4" |
| Tear Energy | $77^{\circ}\text{F} \pm 2^{\circ}$ | 8 ea | 0.1" x 1.18" x 3" |
| Poisson's Ratio (Strain Dila- tation) | $77^{\circ}\text{F} \pm 2^{\circ}$ 10, 15, 20, 25, 30% | 6 per/ condition | 0.50" x 0.50" x 4" |

STATISTICAL ANALYSIS

The objective of this statistical analysis was to determine whether or not any aging trends are demonstrated by accumulated test data in order to assist Service Engineering to more accurately predict motor serviceability.

Propellant was made available for testing and statistical analysis was performed on the resultant data in order to obtain an overall view of the aging trends affecting the First Stage Dissected Motor Program. The sampling consisted of data from two dissected operational motors (0012099 and 0012199), and one motor (STM-012) which was prepared by Thiokol specifically for the dissection program. In addition, carton propellant data (batch UP-7775) which was tested previously was included in the regression analyses.

A new technique of Multi-symbol Regression Analysis Program was used to determine aging trends. The sampling is combined for each test parameter in a single regression analysis. The linear equation ($Y = a + bX$) was found to be the best fit model for the data in this report. A composite population aging trend line is then calculated accepting the fact that individual aging of different populations may be masked.

The Multi-symbol Program uses a unique plotting code for each motor and carton data on the regression plots. This method of data plotting allows a visual display of the overall relationship between the various origins of data and how they relate to the overall least square aging trend line.

The regression program uses an analysis with individual data points from different time periods combined to establish a least square aging trend line for the overall data. The variance about the regression line, obtained using individual values of the dependent variable, was used to compute a tolerance interval such that at the 90% confidence level 90% of the population falls within this interval. This tolerance interval was

extrapolated to a maximum of 24 months to give an indication of the statistical significance of the slope of any aging trends. The computer tolerance interval about the composite regression line is wider than what the tolerance interval would be about any individual motor or carton regression line because of the increased data spread introduced by combining different populations of data. The "t" values and the significance of this statistic, which are reported for each regression model, gives an indication of the "statistical significance" of the slope of the aging trend in the Y-axis. Data and regression trend lines were plotted utilizing an IBM-360/65 computer.

ORIGIN SYMBOL TABLE

| <u>Origin</u> | <u>DOM</u> | <u>Wing</u> | <u>Symbol</u> |
|------------------|------------|-------------|---------------|
| Motor 0012099 | 63166 | 2 | 0 |
| Motor 0012199 | 63227 | 2 | 1 |
| Motor STM-012 | 61221 | 1 | S |
| * Carton UP-7775 | 62075 | 1 | U |

* The last of carton UP-7775 block propellant was used up on the previous testing period. No new data for UP-7775 will appear in this report.

TEST RESULTS

Regression analysis is the method of evaluation used in the analysis of the test results.

A. TENSILE:

Low rate tensile test data at 2.0 in/min shows a statistically significant gradual decreasing slope for strain at maximum stress and strain at rupture. Maximum stress and stress at rupture do not show a significant slope. The moduli show a statistically significant increase slope (Figures 1 thru 5).

The 20 in/min low rate tensile test data shows a statistically significant decreasing slope for the strain at maximum stress, strain at rupture and stress at rupture. Maximum stress and modulus do not show a significant slope direction (Figures 6 thru 10).

No significant slope direction is shown for the high rate regressions (Figures 11 thru 15).

High rate triaxial testing shows a statistically significant increasing slope direction for the strains with the stresses showing no significant slope direction. Modulus shows a statistically significant decrease slope direction (Figures 16 thru 20).

Case bond tensile data shows a statistically significant decreasing slope (Figure 21). For this test period 10 specimens from STM-012 and 4 specimens from 0012199 were tested. The failure mode for all STM-012 specimens was 100% adhesive, liner to propellant, and for 0012199 the failure mode was 100% adhesive, liner to propellant for three specimens and for one specimen 50% adhesive, liner to propellant and 50% adhesive, case to liner.

B. CREEP:

For the 10 and 12 pound load test the regressions show a statistically significant decreasing slope (Figures 22 thru 29).

C. STRESS RELAXATION:

Stress relaxation modulus for both 3% and 5% strain shows no significant slope direction except for 5% strain at 10 seconds which shows a statistically significant increase (Figures 30 thru 37).

D. CONSTANT STRAIN:

A statistically significant decreasing slope is shown for constant strain (Figure 38).

E. SHORE HARDNESS:

The Shore A ten second hardness shows no significant slope (Figure 39).

F. DYNAMIC RESPONSE:

The loss tangent regression for 200 and 400 Hz show a non-significant slope trend. The storage shear modulus at 200 and 400 Hz shows a statically significant decreasing slope (Figures 40 thru 43).

G. TEAR ENERGY:

No significant slope is seen for tear energy (Figure 44).

H. SOL GEL:

The percent extractables and weight swell ratio shows no significant slope (Figures 45 and 46). Sol gel, density and crosslink density show a statistically significant decreasing slope (Figures 47 and 48).

I. BURNING RATE:

A statistically significant decreasing slope is shown for both the 500 and 1000 psi testing (Figures 49 and 50),

J. HEAT OF EXPLOSING (HOE):

The HOE regression shows statistically increasing slope (Figure 51).

K. DIFFERENTIAL THERMAL ANALYSIS (DTA):

The endotherm does not show a significant slope direction (Figure 52). The exotherm shows a statistically significant decreasing slope and the ignition temperature shows a statistically significant increasing slope (Figures 53 and 54).

CONCLUSIONS

The test results show that, under present storage conditions, some of the physical/mechanical and combustion properties of the propellant indicate statistically significant aging trends. On some regressions where a significant trend is indicated, the slope of the trend line is quite gradual and no operational problems are expected. On other regressions, i.e., triaxial tensile and burning rate, the slope of the trend line appears quite steep although, in reality, the percent change is minor as indicated by the formulas found at the top of each figure. The Y-axis range is automatically varied by the data spread to provide visibility between individual data means. As a result, the range values (on Y-axis) must be considered when visually analyzing regression slopes.

Although some aging trends have been observed, it does not appear that any significant degradation will occur in the propellant within the next two years.

RECOMMENDATIONS

It is recommended that continued testing be conducted on the three dissected motors presently being tested and also on those motors selected for future dissection and testing by Service Engineering. On those motors selected for future dissection, testing should include the propellant, casebond specimens, and component materials.

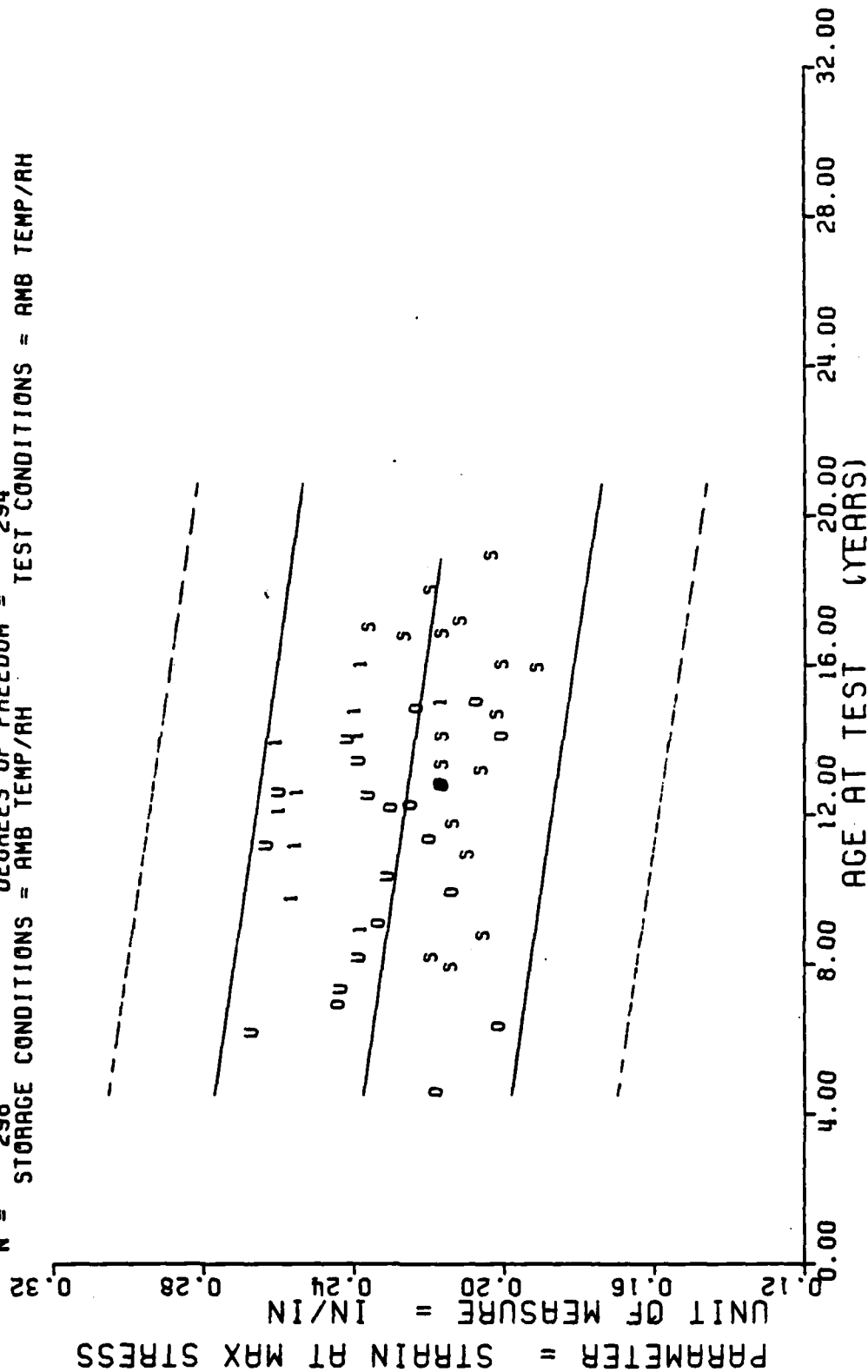
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 54.0 | 26 | 159.0 | 24 |
| 73.0 | 24 | 160.0 | 5 |
| 75.0 | 2 | 166.0 | 5 |
| 82.0 | 5 | 167.0 | 5 |
| 87.0 | 5 | 168.0 | 16 |
| 94.0 | 16 | 175.0 | 8 |
| 97.0 | 7 | 176.0 | 3 |
| 104.0 | 5 | 177.0 | 5 |
| 106.0 | 5 | 179.0 | 8 |
| 108.0 | 5 | 190.0 | 3 |
| 116.0 | 5 | 191.0 | 12 |
| 118.0 | 5 | 200.0 | 3 |
| 123.0 | 4 | 201.0 | 3 |
| 130.0 | 5 | 203.0 | 5 |
| 133.0 | 15 | 205.0 | 3 |
| 135.0 | 2 | 215.0 | 2 |
| 140.0 | 5 | 226.0 | 3 |
| 144.0 | 5 | | |
| 145.0 | 3 | | |
| 146.0 | 2 | | |
| 149.0 | 3 | | |
| 150.0 | 10 | | |
| 152.0 | 2 | | |
| 153.0 | 5 | | |
| 157.0 | 3 | | |

STAGE 1 DISSECTED MOTICRS.LOW RATE CHS=2.0 IN/MIN.STRAIN MAX STRESS

This sample size summary is applicable to figures 1 thru 4

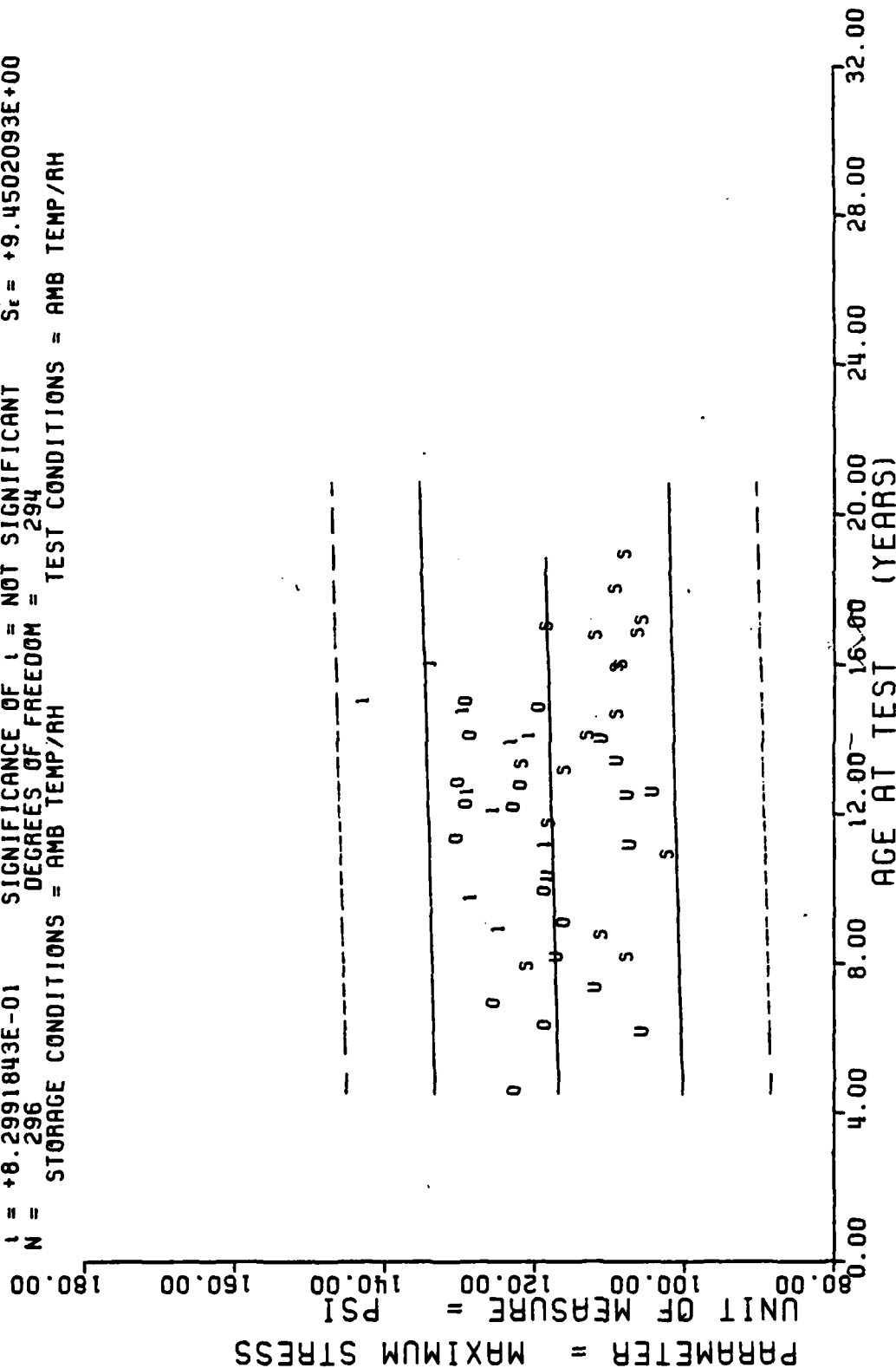
$F = +1.8247085E+01$ SIGNIFICANCE OF $F =$ SIGNIFICANT
 $R = -2.4173946E-01$ SIGNIFICANCE OF $R =$ SIGNIFICANT
 $t = +4.2716607E+00$ SIGNIFICANCE OF $t =$ SIGNIFICANT
 $N = 296$ DEGREES OF FREEDOM = 294
 $Y = ((+2.4405581E-01) + (-1.2129311E-04) \times X)$
 $\sigma_f = +2.3242658E-02$
 $S_o = +2.8394837E-05$
 $S_e = +2.2591632E-02$
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTED MOTORS, LOW RATE CHS=2.0 IN/MIN, STRAIN MAX STRESS

Figure 1

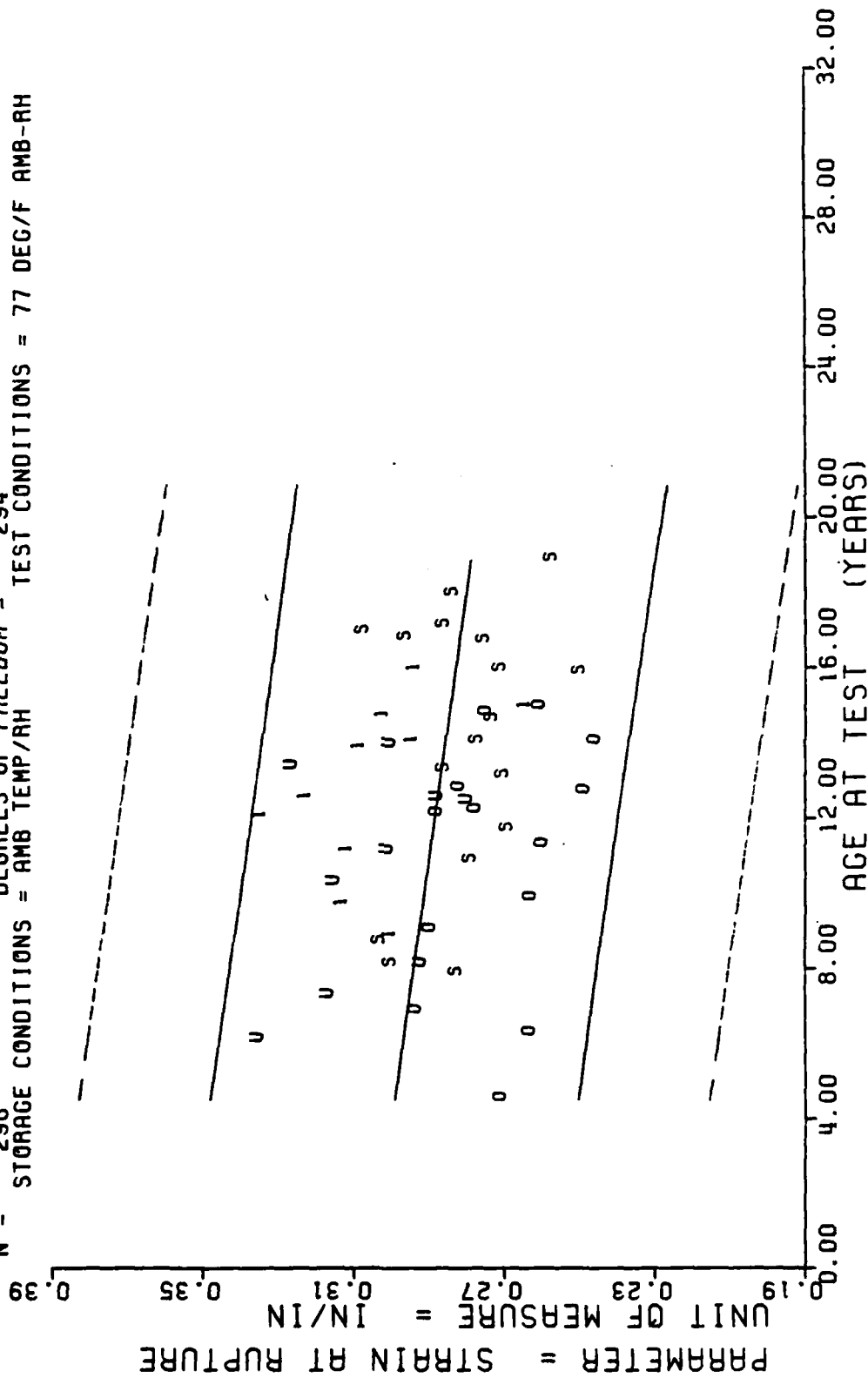
$Y = ((+1.1626123E+02) + (+9.8575414E-03) \times X)$
 $F = +6.8876461E-01$ SIGNIFICANCE OF F = NOT SIGNIFICANT $\sigma_1 = +9.4452229E+00$
 $R = +4.8345229E-02$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_0 = +1.1877723E-02$
 $I = +8.2991843E-01$ SIGNIFICANCE OF I = NOT SIGNIFICANT $S_t = +9.4502093E+00$
 $N = 296$ DEGREES OF FREEDOM = 294
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTED MOTORS, LOW RATE CHS=2.0 IN/MIN, MAXIMUM STRESS

Figure 2

$F = +1.1461158E+01$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = -1.9370296E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $I = +3.3854333E+00$ SIGNIFICANCE OF I = SIGNIFICANT
 $N = 296$ DEGREES OF FREEDOM = 294
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = 77 DEG/F AMB-RH



STAGE 1 DISSECTED MOTORS, LOW RATE CHS=2.0 IN/MIN, STRAIN AT RUPTURE

Figure 3

| PARAMETER = STRESS AT RUPTURE | UNIT OF MEASURE = PSI | AGE AT TEST (YEARS) | S _t = +9.5477187E+00 |
|-------------------------------|-----------------------|---------------------|---------------------------------|
| | | 0.00 | |
| | | 4.00 | |
| | | 8.00 | |
| | | 12.00 | |
| | | 16.00 | |
| | | 20.00 | |
| | | 24.00 | |
| | | 28.00 | |
| | | 32.00 | |

STAGE 1 DISSECTED MOTORS. LOW RATE CHS=2.0 IN/MIN, STRESS AT RUPTURE

Figure 4

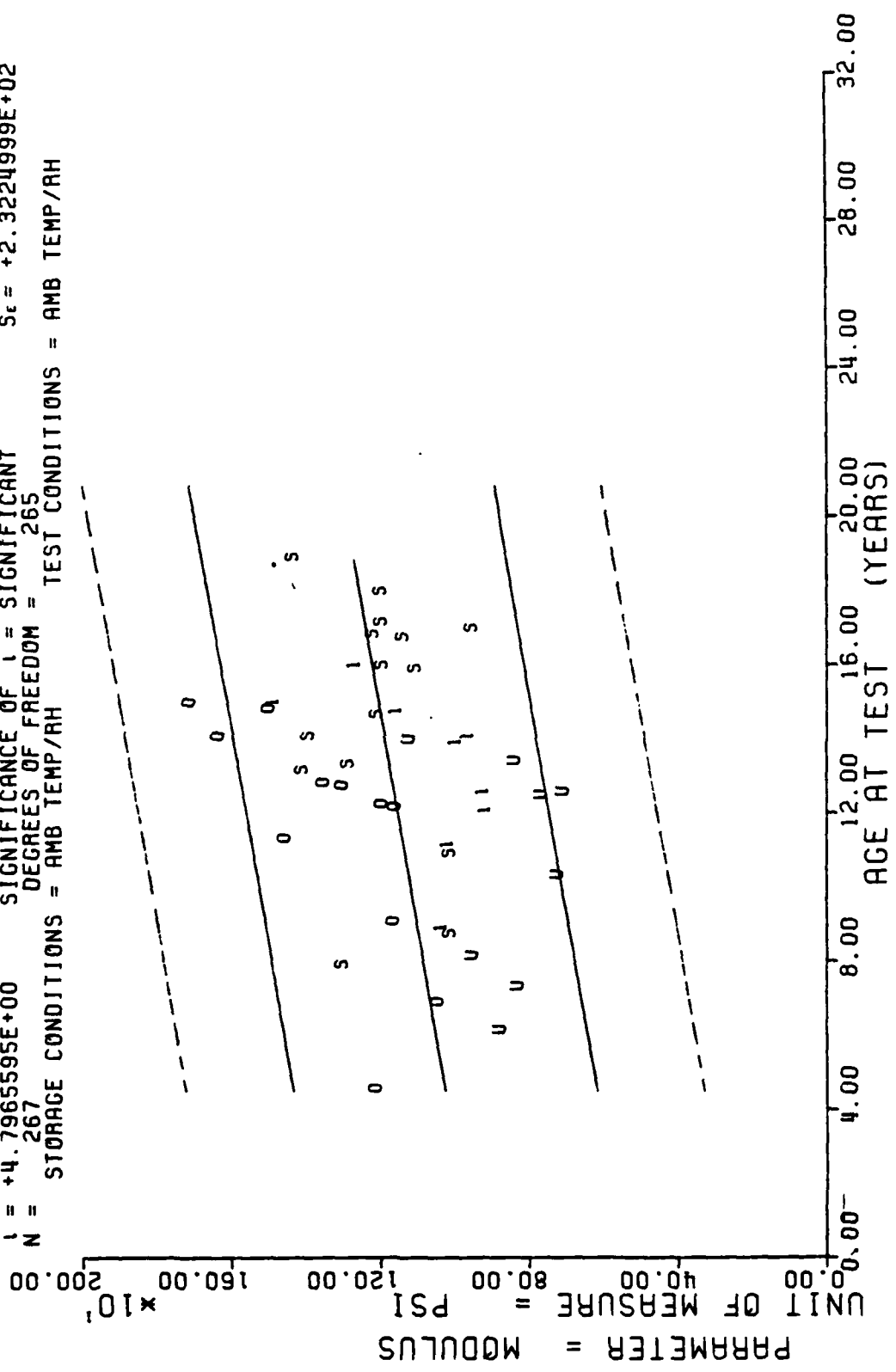
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 54.0 | 26 | 168.0 | 16 |
| 73.0 | 24 | 175.0 | 8 |
| 82.0 | 5 | 176.0 | 3 |
| 87.0 | 5 | 177.0 | 5 |
| 94.0 | 16 | 179.0 | 8 |
| 97.0 | 5 | 190.0 | 3 |
| 104.0 | 5 | 191.0 | 13 |
| 106.0 | 5 | 200.0 | 3 |
| 108.0 | 5 | 201.0 | 3 |
| 123.0 | 4 | 203.0 | 5 |
| 130.0 | 5 | 205.0 | 3 |
| 133.0 | 5 | 215.0 | 8 |
| 135.0 | 3 | 226.0 | 3 |
| 144.0 | 5 | | |
| 145.0 | 3 | | |
| 146.0 | 2 | | |
| 149.0 | 3 | | |
| 150.0 | 10 | | |
| 152.0 | 3 | | |
| 153.0 | 5 | | |
| 157.0 | 3 | | |
| 159.0 | 24 | | |
| 160.0 | 5 | | |
| 166.0 | 5 | | |
| 167.0 | 5 | | |

STAGE 1 DISSECTED MOTICRS,LOW RATE CHS=2.0 IN/MIN,MODULUS

This sample size summary is applicable to figure 5

$Y = ((+9.4867984E+02) + (+1.4157983E+00) * X)$
 $F = +2.3006983E+01$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = +2.8263655E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $I = +4.7965595E+00$ SIGNIFICANCE OF I = SIGNIFICANT
 $N = 267$ DEGREES OF FREEDOM = 265
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTED MOTORS, LOW RATE CHS=2.0 IN/MIN, MODULUS

Figure 5

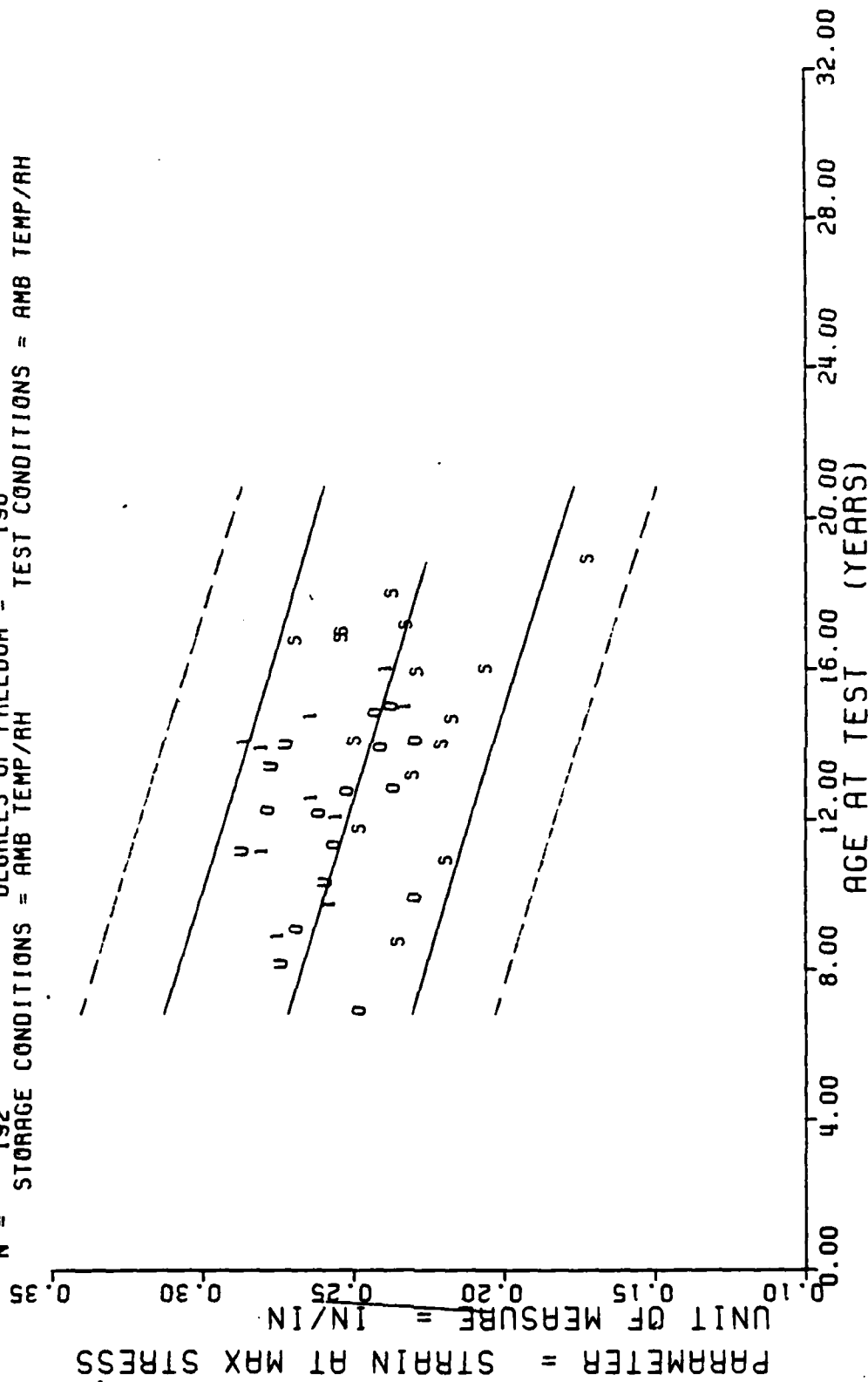
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 82.0 | 2 | 177.0 | 2 |
| 97.0 | 5 | 179.0 | 8 |
| 104.0 | 2 | 190.0 | 3 |
| 106.0 | 5 | 191.0 | 13 |
| 108.0 | 5 | 200.0 | 3 |
| 116.0 | 5 | 201.0 | 3 |
| 118.0 | 5 | 203.0 | 5 |
| 123.0 | 5 | 205.0 | 3 |
| 130.0 | 5 | 215.0 | 5 |
| 133.0 | 14 | 226.0 | 3 |
| 135.0 | 3 | | |
| 140.0 | 5 | | |
| 144.0 | 4 | | |
| 145.0 | 3 | | |
| 146.0 | 2 | | |
| 150.0 | 9 | | |
| 152.0 | 3 | | |
| 153.0 | 5 | | |
| 157.0 | 7 | | |
| 160.0 | 5 | | |
| 166.0 | 8 | | |
| 167.0 | 7 | | |
| 168.0 | 15 | | |
| 175.0 | 8 | | |
| 176.0 | 3 | | |

STAGE 1 DISSECTED NOTICES, LOW RATE CHS=20.0 IN/MIN, STRAIN MAX STRESS

This sample size summary is applicable to figures 6 thru 9

$Y = ((+2.9795114E-01) + (-3.1899379E-04) * X)$
 $F = +3.8947933E+01$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = -4.1245241E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $I = +6.2408279E+00$ SIGNIFICANCE OF I = SIGNIFICANT
 $N = 192$ DEGREES OF FREEDOM = 190
 $N = 192$ STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTED MOTORS, LOW RATE CHS=20.0 IN/MIN, STRAIN MAX STRESS

Figure 6

$Y = ((+1.5336050E+02) + (-4.5525406E-02) * X)$
 $F = +2.1877265E+00$ SIGNIFICANCE OF F = NOT SIGNIFICANT $\sigma_r = +1.3852131E+01$
 $R = -1.0669245E-01$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_e = +3.0779198E-02$
 $t = +1.4790965E+00$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_e = +1.3809262E+01$
 $N = 192$ DEGREES OF FREEDOM = 190
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

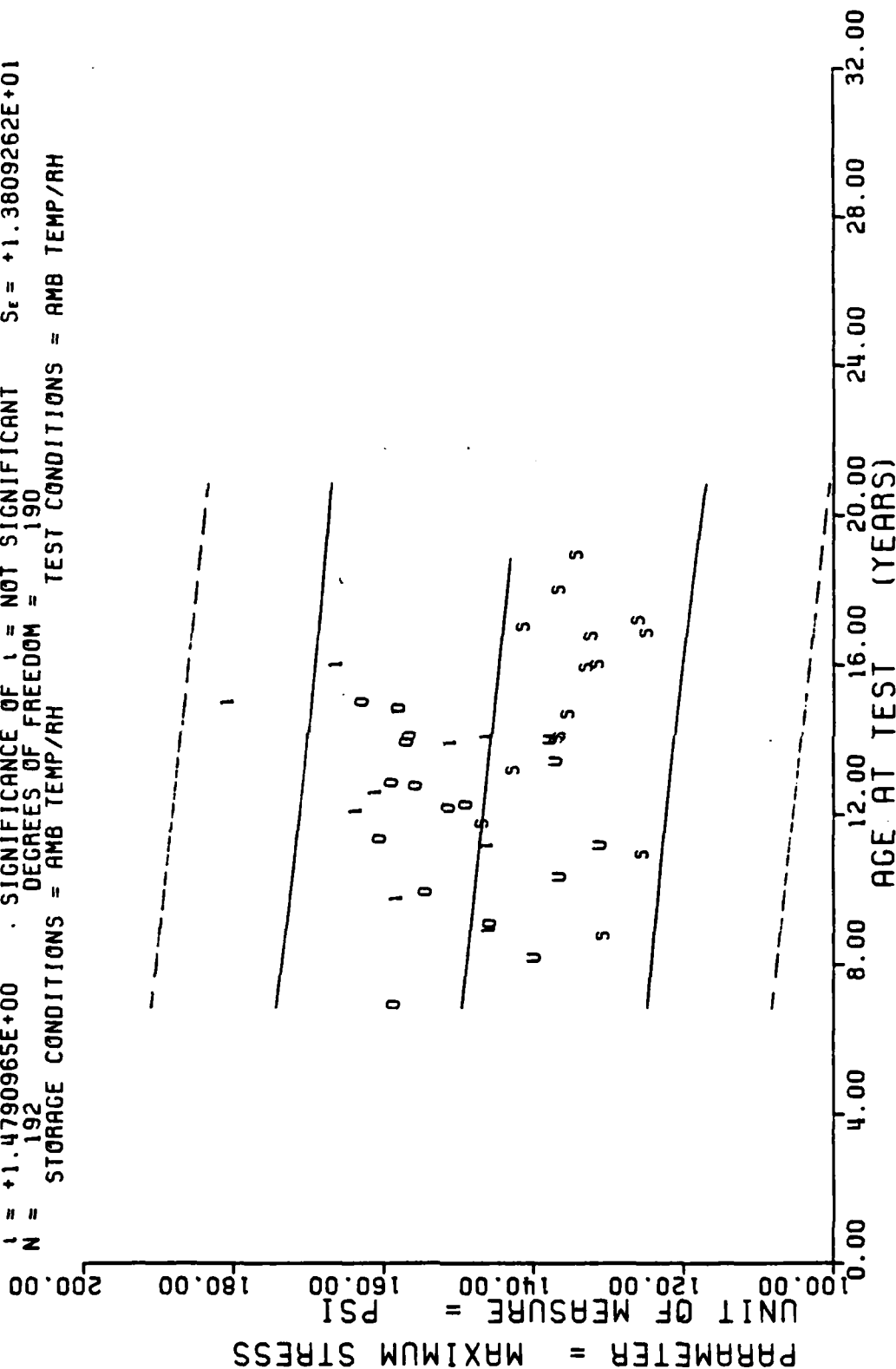
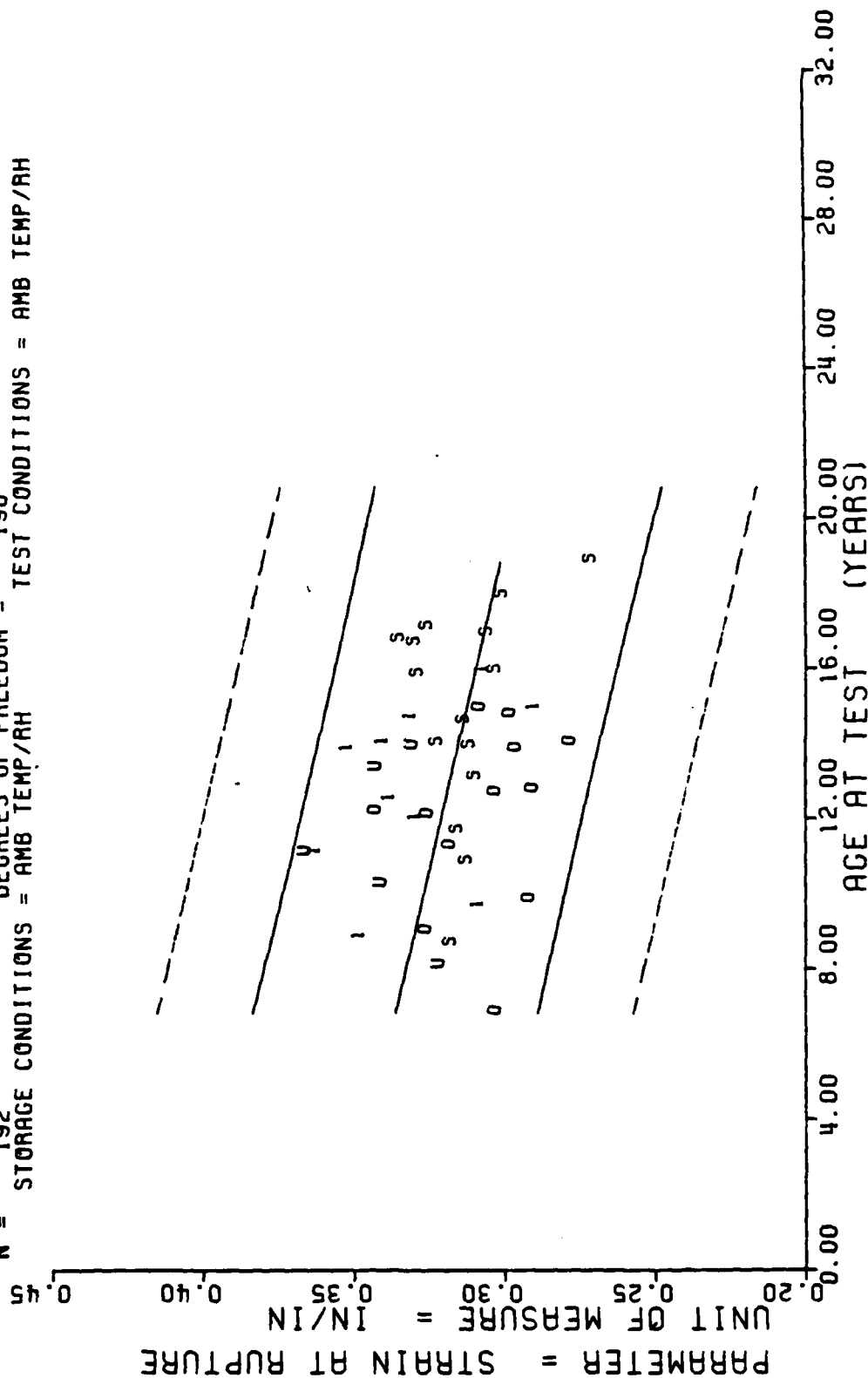


Figure 7

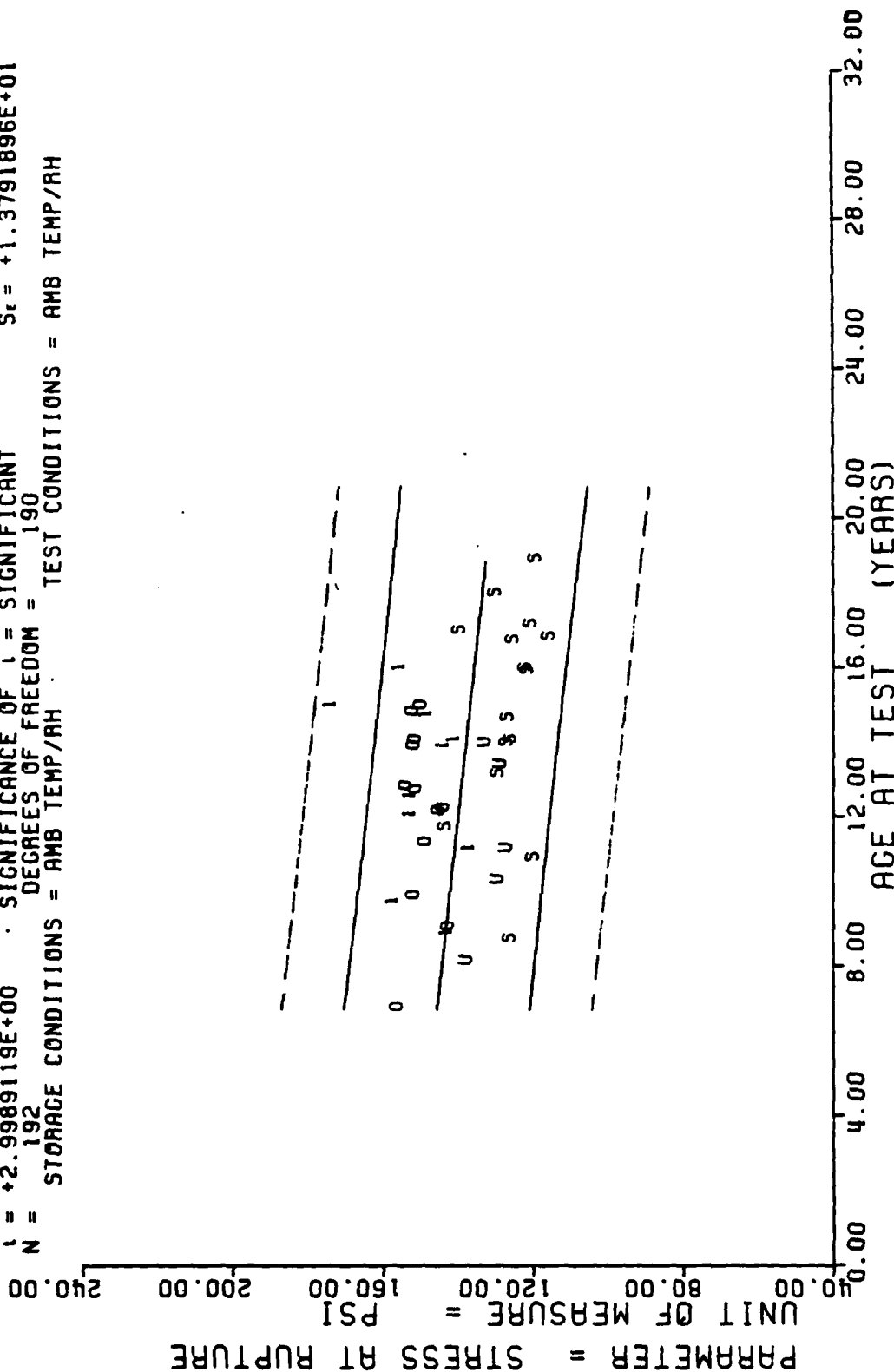
$F = +1.7307197E+01$ SIGNIFICANCE OF F = SIGNIFICANT $G_1 = +2.7455535E-02$
 $R = -2.8893901E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_1 = +5.8738957E-05$
 $I = +4.1601920E+00$ SIGNIFICANCE OF I = SIGNIFICANT $S_2 = +2.6353566E-02$
 $N = 192$ DEGREES OF FREEDOM = 190
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTED MOTORS, LOW RATE CHS=20.0 IN/MIN, STRAIN AT RUPTURE

Figure 8

$Y = ((+1.5326477E+02) + (-9.2188033E-02) * X)$
 $F = +8.9934730E+00$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_1 = +1.4077538E+01$
 $R = -2.1259071E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_1 = +3.0740493E-02$
 $I = +2.9989119E+00$ SIGNIFICANCE OF I = SIGNIFICANT $S_2 = +1.3791896E+01$
 $N = 192$ DEGREES OF FREEDOM = 190
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



STAGE 1 DISSECTED MOTORS, LOW RATE CHS=20.0 IN/MIN, STRESS AT RUPTURE

Figure 9

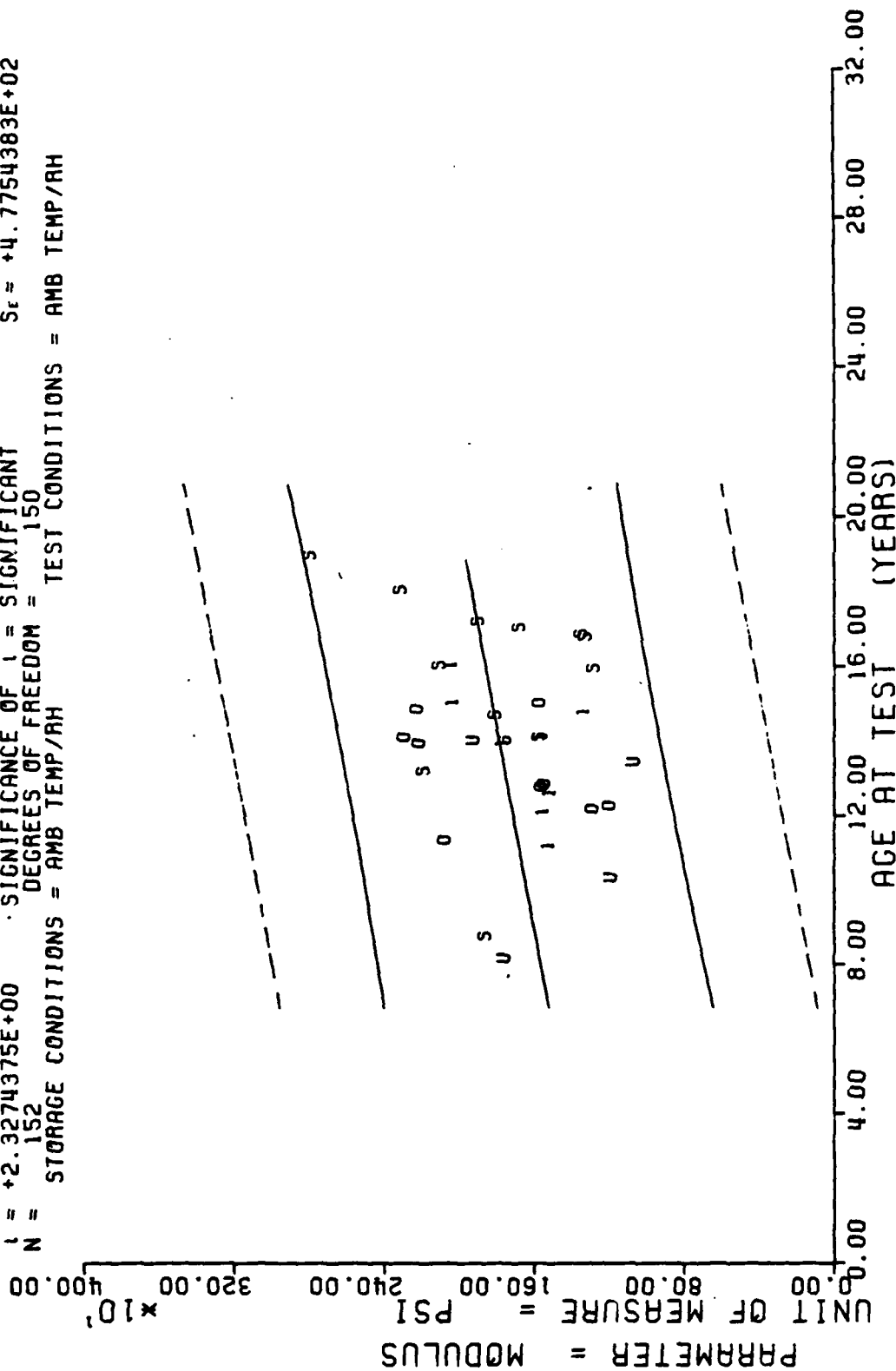
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 82.0 | 2 | 203.0 | 5 |
| 97.0 | 5 | 205.0 | 3 |
| 104.0 | 2 | 215.0 | 5 |
| 123.0 | 5 | 226.0 | 3 |
| 133.0 | 4 | | |
| 135.0 | 3 | | |
| 144.0 | 4 | | |
| 145.0 | 3 | | |
| 146.0 | 2 | | |
| 150.0 | 5 | | |
| 152.0 | 3 | | |
| 153.0 | 5 | | |
| 157.0 | 7 | | |
| 160.0 | 5 | | |
| 166.0 | 8 | | |
| 167.0 | 7 | | |
| 168.0 | 15 | | |
| 175.0 | 8 | | |
| 176.0 | 3 | | |
| 177.0 | 2 | | |
| 179.0 | 6 | | |
| 190.0 | 3 | | |
| 191.0 | 13 | | |
| 200.0 | 3 | | |
| 201.0 | 3 | | |

STAGE 1 DISSECTED MCTCFS, LOW RATE CFS=20.0 IN/MIN. MODULUS

This sample size summary is applicable to figure 10

$Y = ((+1.2738665E+03) + (+3.0380642E+00) \times X)$
 $F = +5.4169657E+00$ SIGNIFICANCE OF F = SIGNIFICANT
 $R = +1.8669334E-01$ SIGNIFICANCE OF R = SIGNIFICANT
 $t = +2.3274375E+00$ SIGNIFICANCE OF t = SIGNIFICANT
 $N = 152$ DEGREES OF FREEDOM = 150
 STORAGE CONDITIONS = AMB TEMP/4H TEST CONDITIONS = AMB TEMP/4H



STAGE 1 DISSECTED MOTORS, LOW RATE CHS=20.0 IN/MIN, MODULUS

Figure 10

*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 60.0 | 6 | 226.0 | 6 |
| 71.0 | 4 | | |
| 80.0 | 16 | | |
| 83.0 | 5 | | |
| 93.0 | 6 | | |
| 105.0 | 6 | | |
| 107.0 | 5 | | |
| 109.0 | 5 | | |
| 116.0 | 6 | | |
| 118.0 | 6 | | |
| 131.0 | 5 | | |
| 134.0 | 5 | | |
| 136.0 | 4 | | |
| 141.0 | 6 | | |
| 144.0 | 5 | | |
| 146.0 | 5 | | |
| 151.0 | 5 | | |
| 154.0 | 5 | | |
| 158.0 | 5 | | |
| 176.0 | 5 | | |
| 177.0 | 6 | | |
| 179.0 | 7 | | |
| 191.0 | 5 | | |
| 201.0 | 5 | | |
| 202.0 | 6 | | |

STAGE 1 DISSECTED VOICES, HIGH RATE CPS=1750 IN/MIN. STRAIN MAX STRESS

This sample size summary is applicable to figures 11 thru 15

PARAMETER = STRAIN AT MAX STRESS

UNIT OF MEASURE = IN/IN

AGE AT TEST (YEARS)

STORAGE CONDITIONS = AMB TEMP/RH

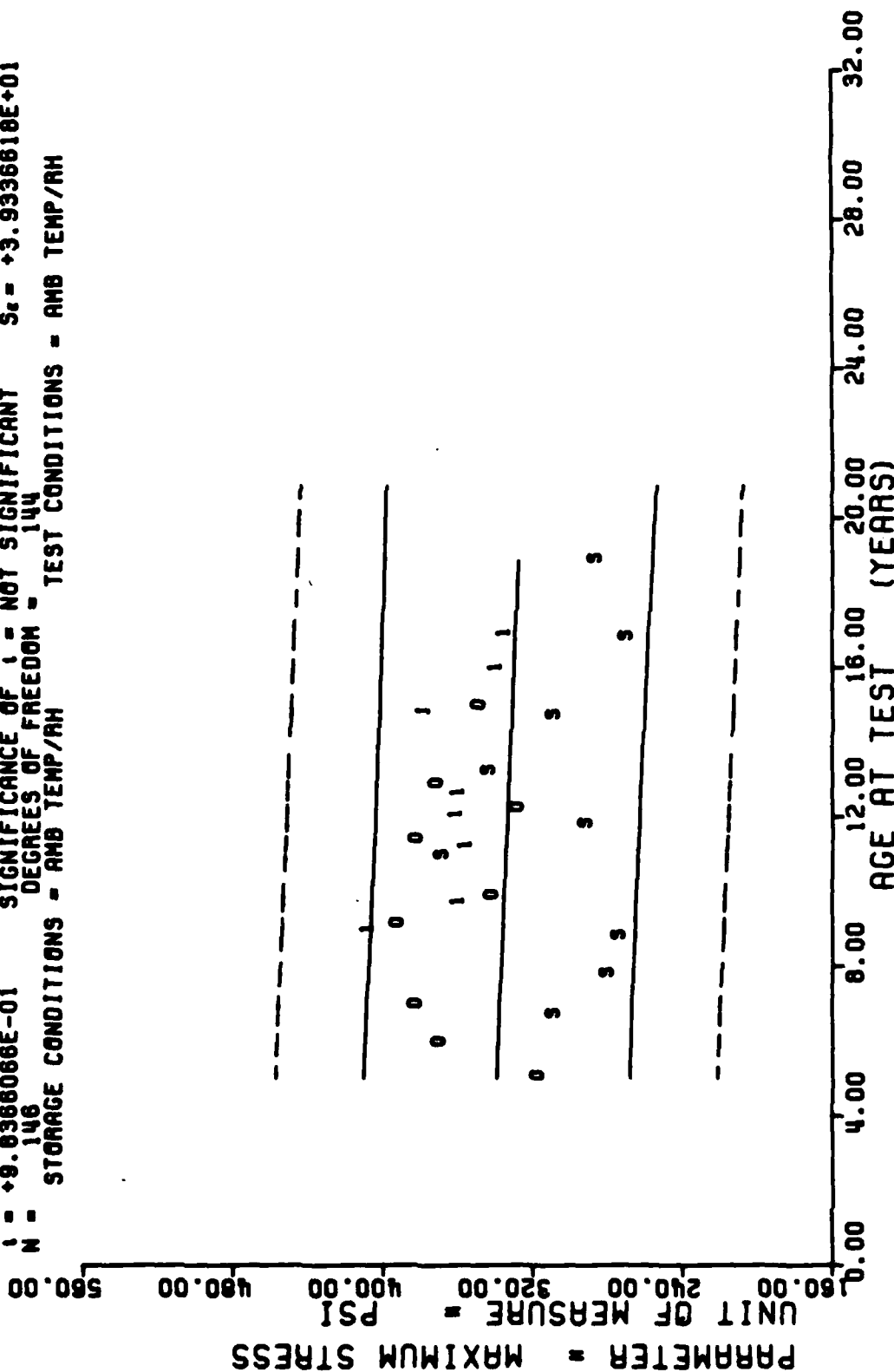
TEST CONDITIONS = AMB TEMP/RH

| Age at Test (Years) | Strain at Max Stress (IN/IN) | Condition |
|---------------------|------------------------------|-----------|
| 0.00 | 0.10 | S |
| 4.00 | 0.10 | S |
| 8.00 | 0.10 | S |
| 12.00 | 0.10 | S |
| 16.00 | 0.10 | S |
| 20.00 | 0.10 | S |
| 24.00 | 0.10 | S |
| 28.00 | 0.10 | S |
| 32.00 | 0.10 | S |

STAGE 1 DISSECTED MOTORS, HIGH RATE CHS=1750 IN/MIN, STRAIN MAX STRESS

Figure 11

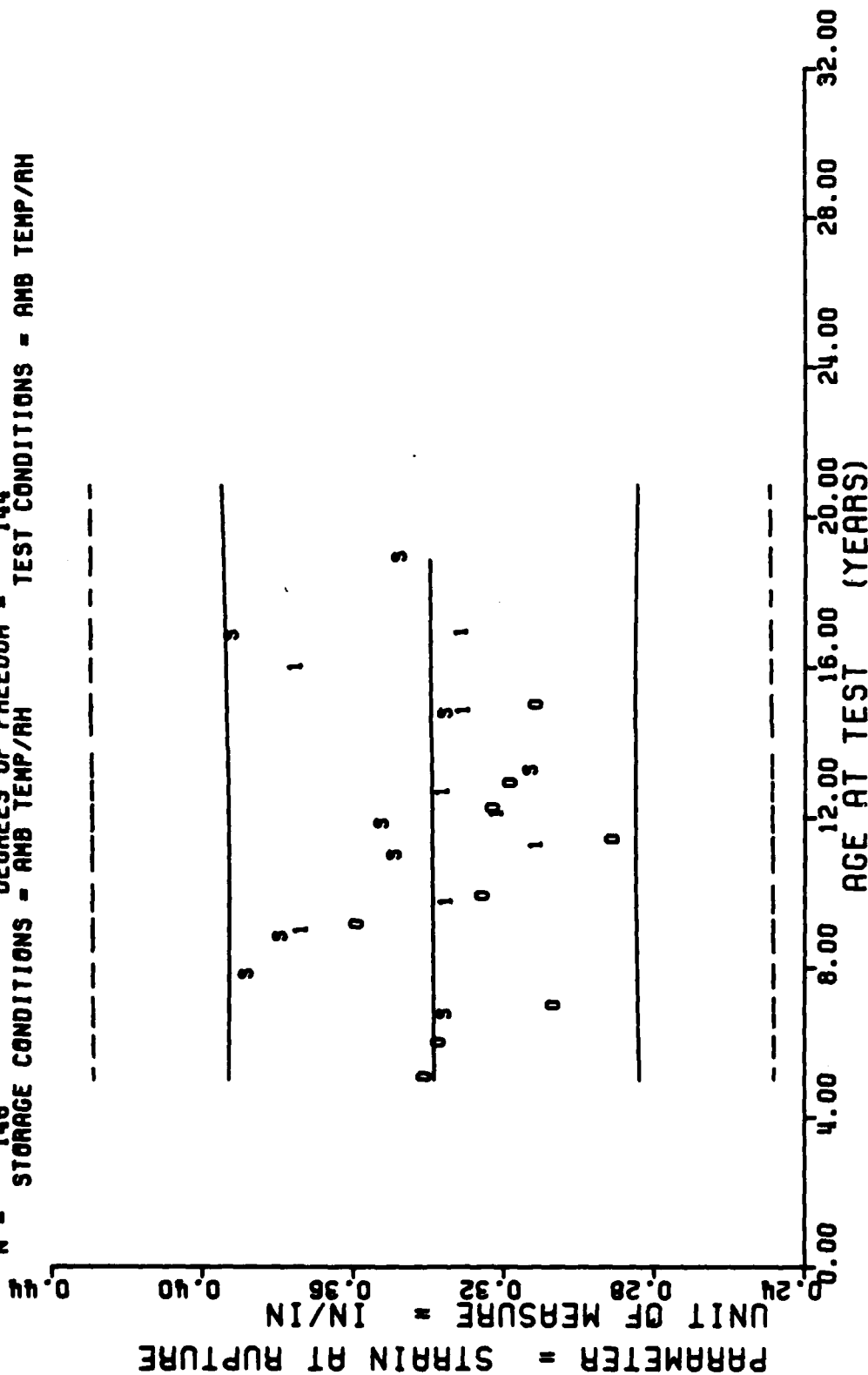
F = +9.6758831E-01
 R = -0.1897703E-02
 I = +9.0366066E-01
 N = 146
 Y = ((+3.4378114E+02) + (-7.2499092E-02) * X)
 SIGNIFICANCE OF F = NOT SIGNIFICANT
 SIGNIFICANCE OF R = NOT SIGNIFICANT
 SIGNIFICANCE OF I = NOT SIGNIFICANT
 DEGREES OF FREEDOM = 144
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTED MOTORS, HIGH RATE CHS-1750 IN/MIN, MAXIMUM STRESS

Figure 12

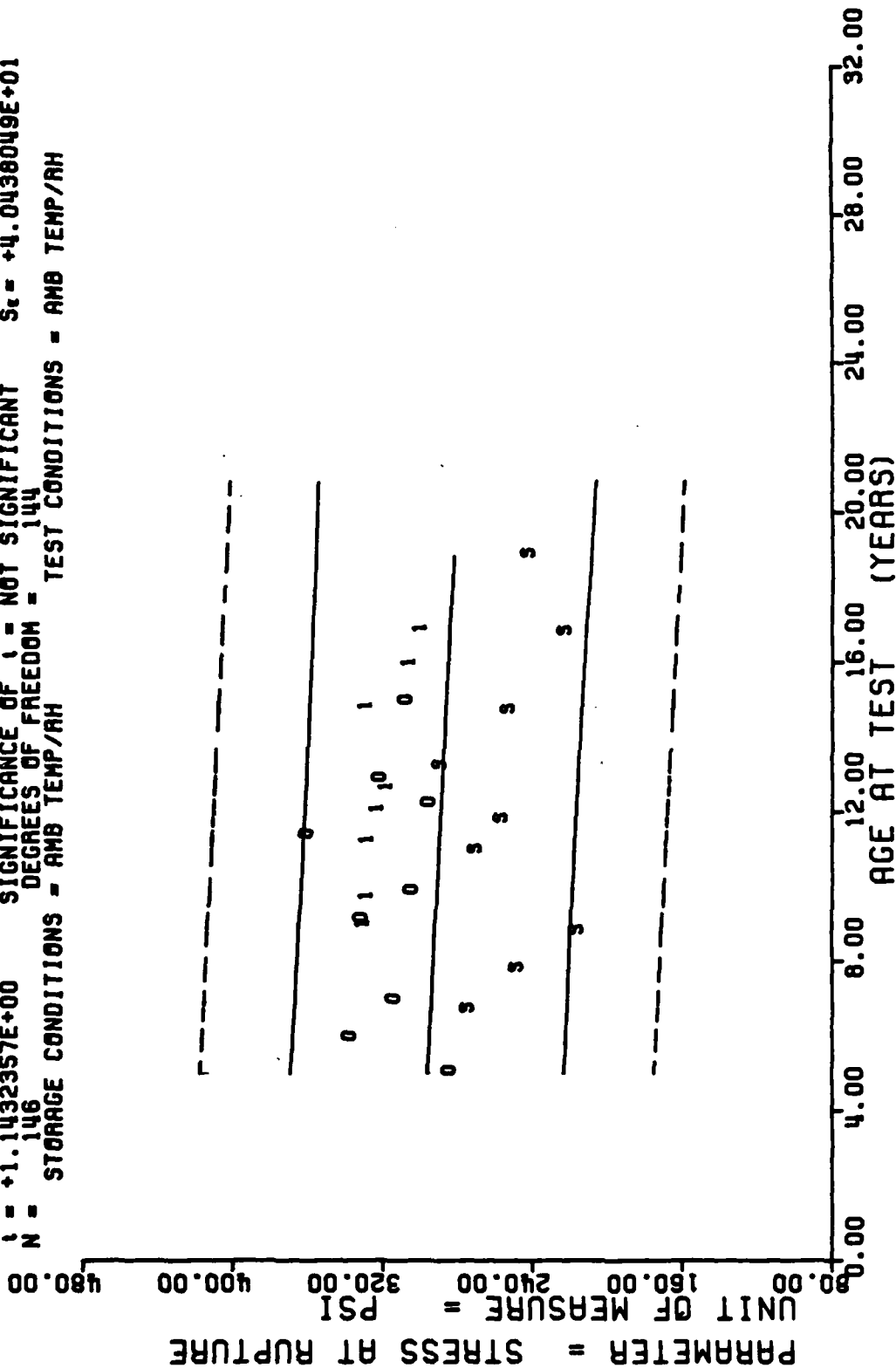
$Y = ((+3.3810743E-01) + (+6.8475750E-06) \times X)$
 $F = +1.4700791E-02$ SIGNIFICANCE OF F = NOT SIGNIFICANT $\sigma_r = +3.0039701E-02$
 $R = +1.010386E-02$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_r = +5.6476325E-05$
 $t = +1.2124682E-01$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_t = +3.0142286E-02$
 $N = 146$ DEGREES OF FREEDOM = 144
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTED MOTORS, HIGH RATE CHS-1750 IN/MIN, STRAIN AT RUPTURE

Figure 13

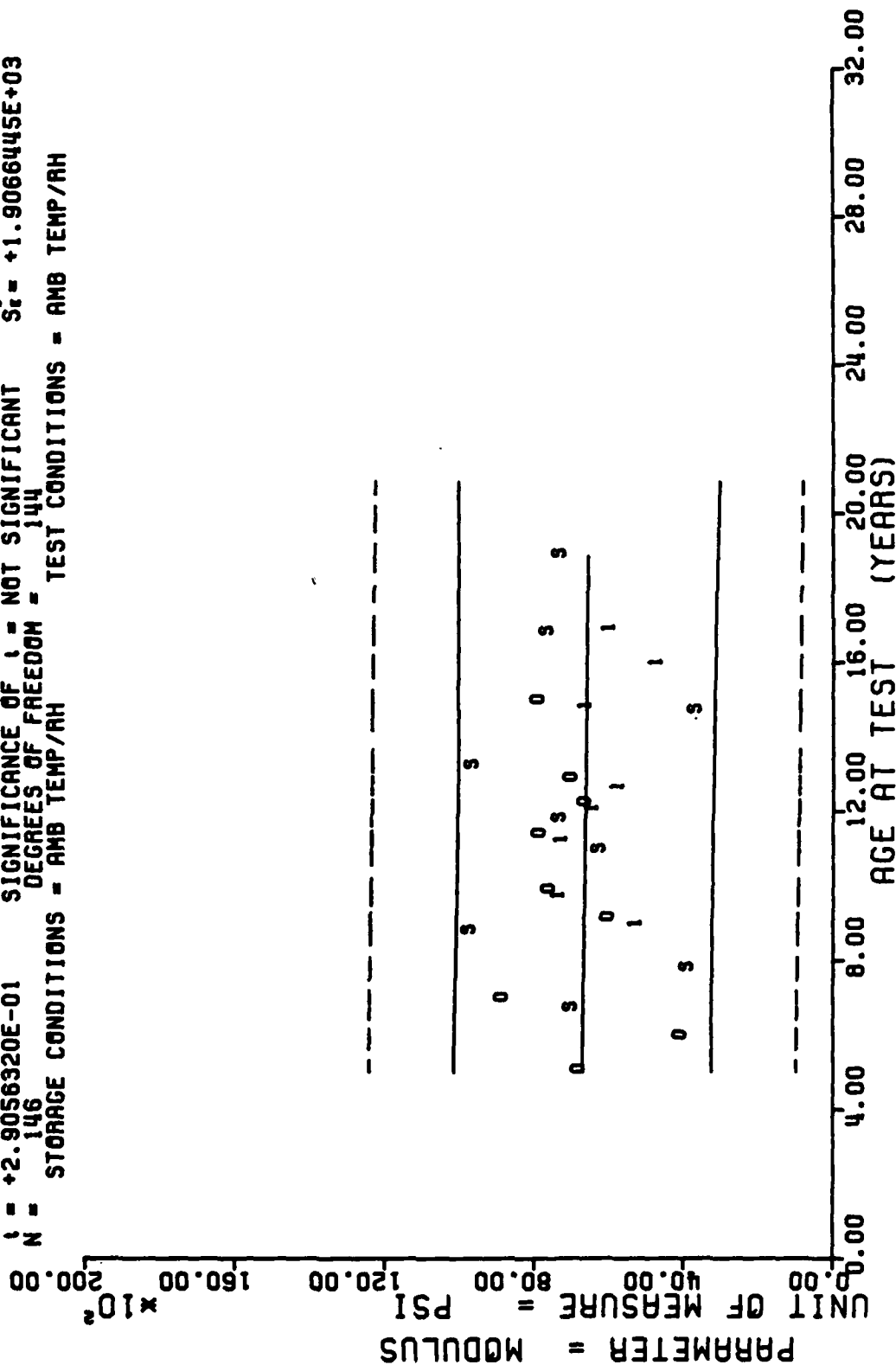
$Y = ((+3.0158341E+02) + (-8.6619611E-02) * X)$
 $F = +1.3069879E+00$ SIGNIFICANCE OF F = NOT SIGNIFICANT $\sigma = +4.0480834E+01$
 $R = -9.4840217E-02$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_e = +7.5767060E-02$
 $t = +1.1432357E+00$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_t = +4.0438049E+01$
 $N = 146$ DEGREES OF FREEDOM = 144
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



STAGE 1 DISSECTED MOTORS, HIGH RATE CHS=1750 IN/MIN, STRESS AT RUPTURE

Figure 14

$Y = ((+6.7734457E+03) + (-1.0380077E+00) \times X)$
 $F = +8.4426976E-02$ SIGNIFICANCE OF F = NOT SIGNIFICANT $\sigma_f = +1.9006154E+03$
 $R = -2.4206505E-02$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_r = +3.5723991E+00$
 $t = +2.9056320E-01$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_t = +1.9066445E+03$
 $N = 146$ DEGREES OF FREEDOM = 144
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTED MOTORS, HIGH RATE CHS=1750 IN/MIN, MODULUS

Figure 15

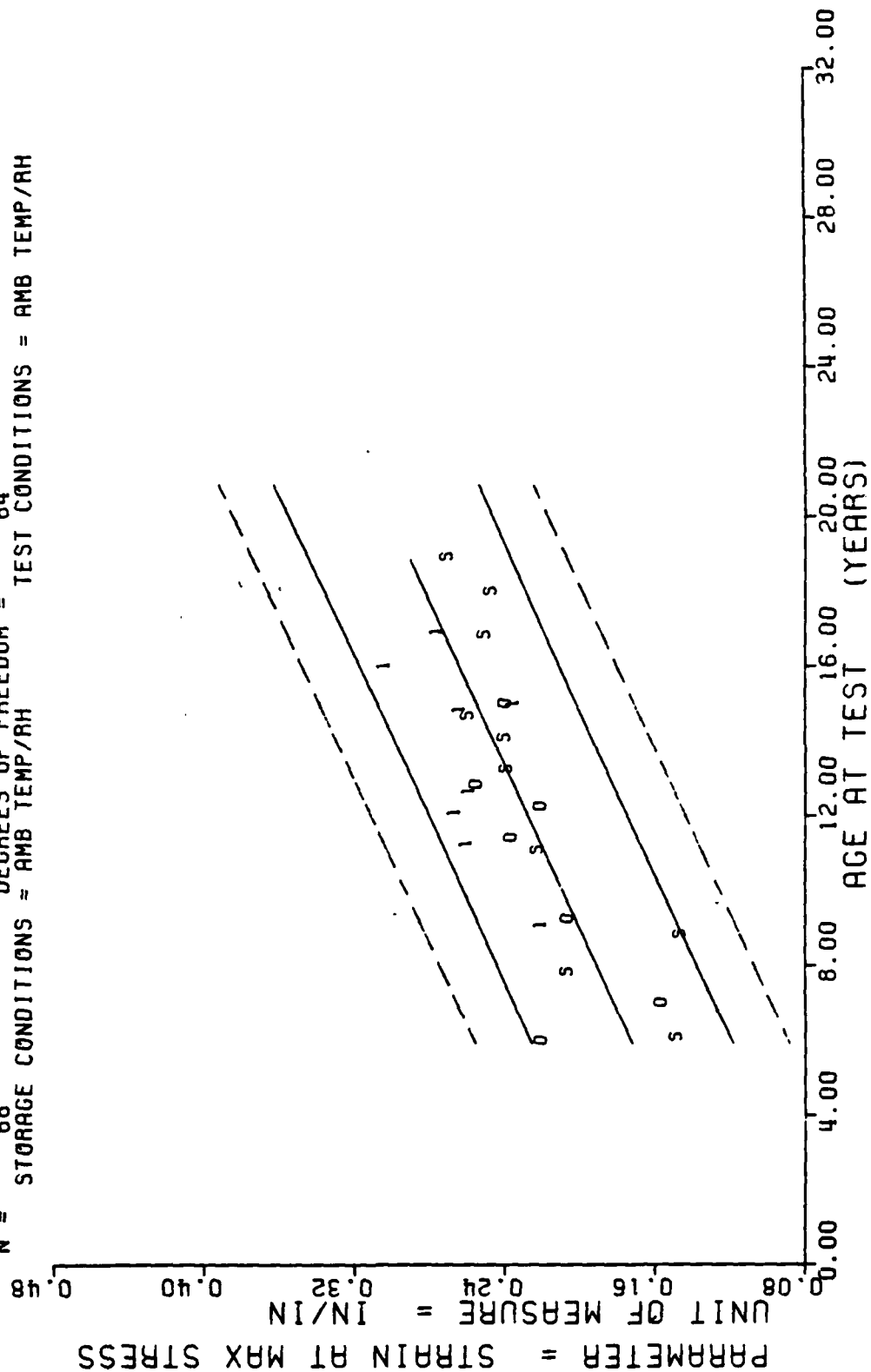
*** SAMPLE SIZE SUMMARY ***

| AGE (MCNTHS) | NR SAMPLES |
|-----------------|---------------|
| 71.0 | 2 |
| 72.0 | 2 |
| 83.0 | 2 |
| 93.0 | 2 |
| 105.0 | 2 |
| 108.0 | 2 |
| 110.0 | 2 |
| 132.0 | 2 |
| 134.0 | 4 |
| 136.0 | 2 |
| 144.0 | 2 |
| 146.0 | 2 |
| 151.0 | 3 |
| 153.0 | 3 |
| 158.0 | 2 |
| 168.0 | 2 |
| 175.0 | 3 |
| 177.0 | 3 |
| 179.0 | 3 |
| 191.0 | 3 |
| 201.0 | 3 |
| 202.0 | 3 |
| 215.0 | 3 |
| 226.0 | 3 |

DISSECTED YP-H1011.H.R.TRIAXIAL CHS=1750 IN/MIN.600 PSI.STPAIN MAX STRESS

This sample size summary is applicable to figures 16 thru 20

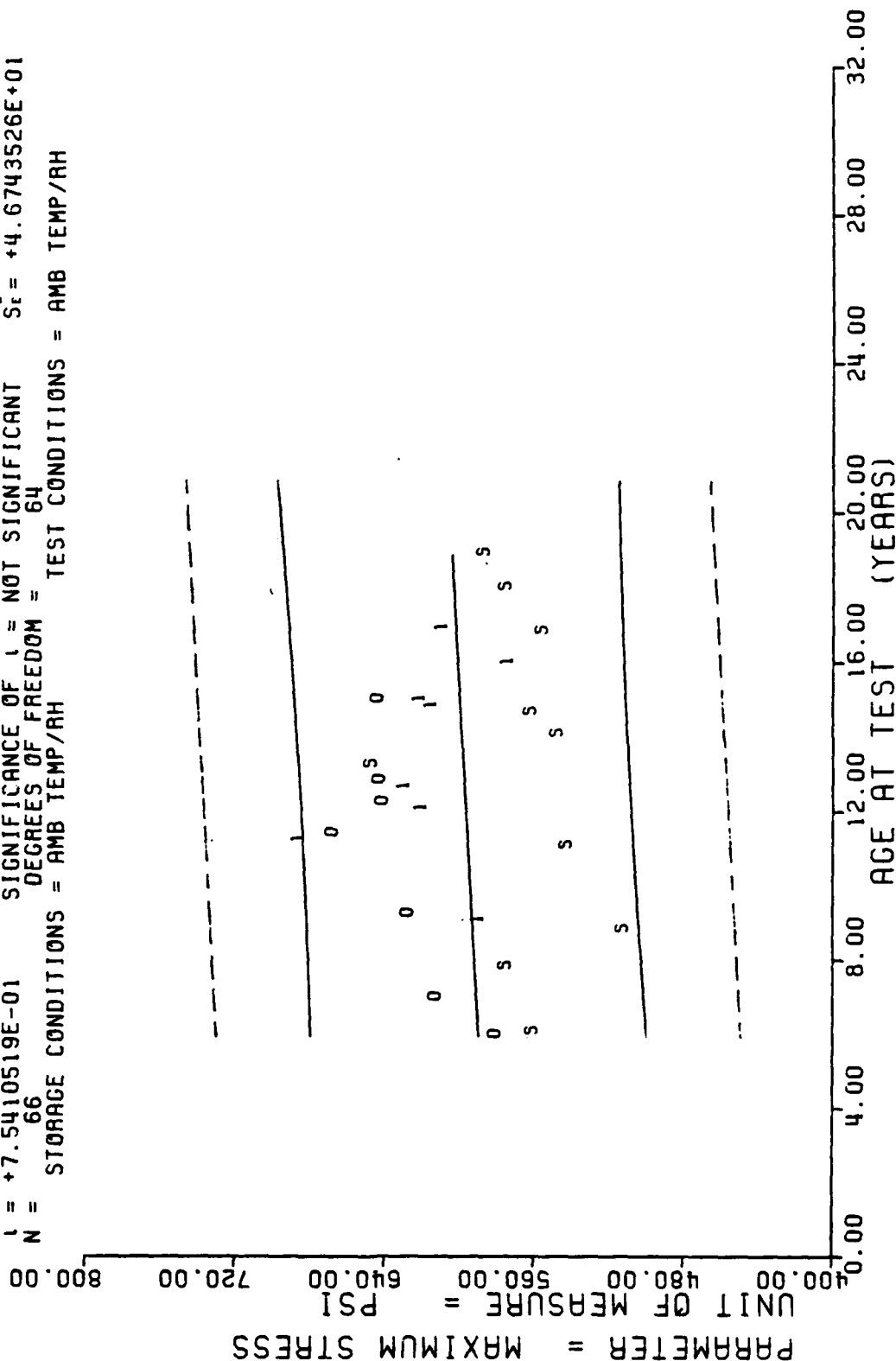
$Y = ((+1.1804317E-01) + (+7.5954832E-04) * X)$
 F = +1.0901920E+02 SIGNIFICANCE OF F = SIGNIFICANT $\sigma_r = +4.5477031E-02$
 R = +7.9378766E-01 SIGNIFICANCE OF R = SIGNIFICANT $S_s = +7.2745127E-05$
 L = +1.0441226E+01 SIGNIFICANCE OF L = SIGNIFICANT $S_t = +2.7874149E-02$
 N = 66 DEGREES OF FREEDOM = 64
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



DISSECTED TP-H1011, H.R. TRIAXIAL CHS=1750 IN/MIN, 600 PSI, STRAIN MAX STRESS

Figure 16

F = +5.6867463E-01
 R = +9.3847129E-02
 I = +7.5410519E-01
 N = 66
 Y = ((+5.8285705E+02) + (+9.1993191E-02) * X)
 SIGNIFICANCE OF F = NOT SIGNIFICANT
 SIGNIFICANCE OF R = NOT SIGNIFICANT
 SIGNIFICANCE OF I = NOT SIGNIFICANT
 DEGREES OF FREEDOM = 64
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = AMB TEMP/RH

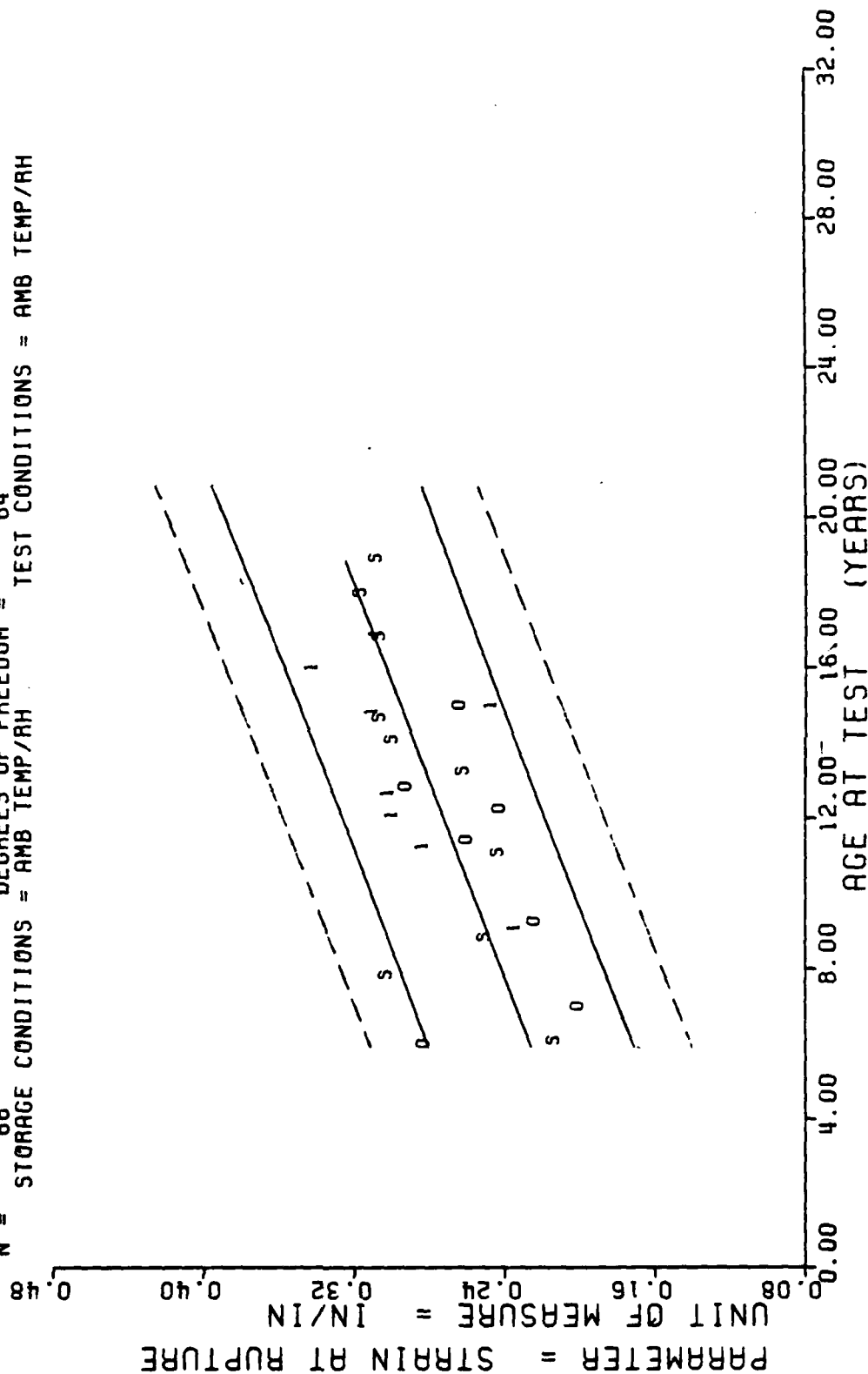


DISSECTED TP-H1011.H.R. TRIAXIAL CHS=1750 IN/MIN, 600 PSI, MAXIMUM STRESS

Figure 17

$F = +7.3120777E+01$
 $R = +7.3024529E-01$
 $I = +8.5510687E+00$
 $N = 66$

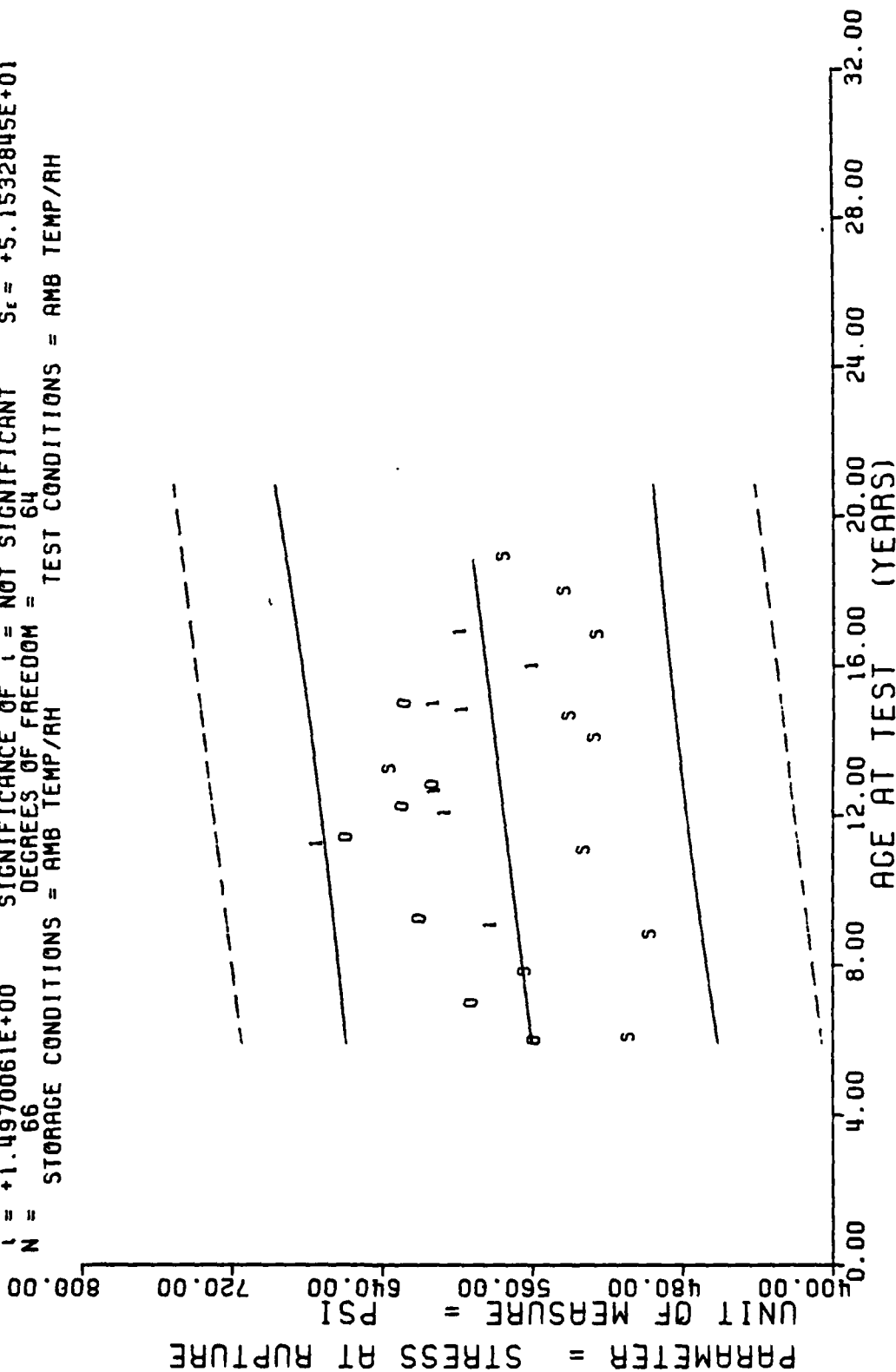
$Y = ((+1.8066666E-01) + (+6.3604365E-04) \times X)$
 SIGNIFICANCE OF F = SIGNIFICANT
 SIGNIFICANCE OF R = SIGNIFICANT
 SIGNIFICANCE OF I = SIGNIFICANT
 DEGREES OF FREEDOM = 64
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = AMB TEMP/RH



DISSECTED TP-H1011.H.R. TRIAXIAL CHS=1750 IN/MIN. 600 PSI. STRAIN AT RUPTURE

Figure 18

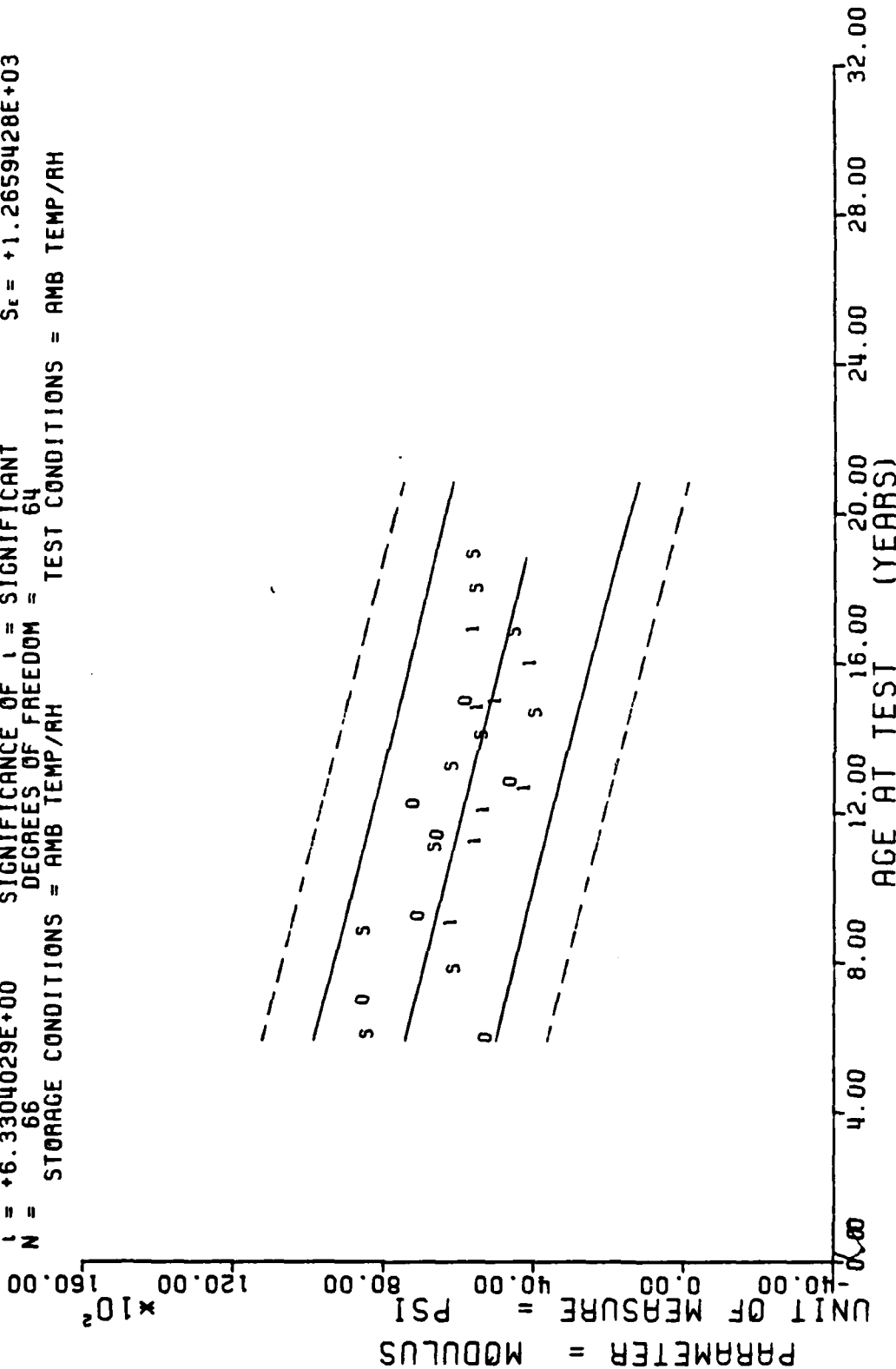
$F = +2.2410273E+00$
 $R = +1.8393316E-01$
 $I = +1.4970061E+00$
 $N = 66$
 $Y = ((+5.4617190E+02) + (+2.0133068E-01) * X)$
 SIGNIFICANCE OF F = NOT SIGNIFICANT
 SIGNIFICANCE OF R = NOT SIGNIFICANT
 SIGNIFICANCE OF I = NOT SIGNIFICANT
 DEGREES OF FREEDOM = 64
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = AMB TEMP/RH



DISSECTED TP-H1011, H.R. TRIAXIAL CHS=1750 IN/MIN, 600 PSI, STRESS AT RUPTURE

Figure 19

$F = +4.0074001E+01$
 $R = -6.2052635E-01$
 $I = +6.3304029E+00$
 $N = 66$
 $Y = .((+8.9189508E+03) + (-2.0914512E+01) * X)$
 SIGNIFICANCE OF F = SIGNIFICANT
 SIGNIFICANCE OF R = SIGNIFICANT
 SIGNIFICANCE OF I = SIGNIFICANT
 DEGREES OF FREEDOM = 64
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = AMB TEMP/RH



DISSECTED TP-H1011, H.R. TRIAXIAL CHS=1750 IN/MIN, 600 PSI, MODULUS

Figure 20

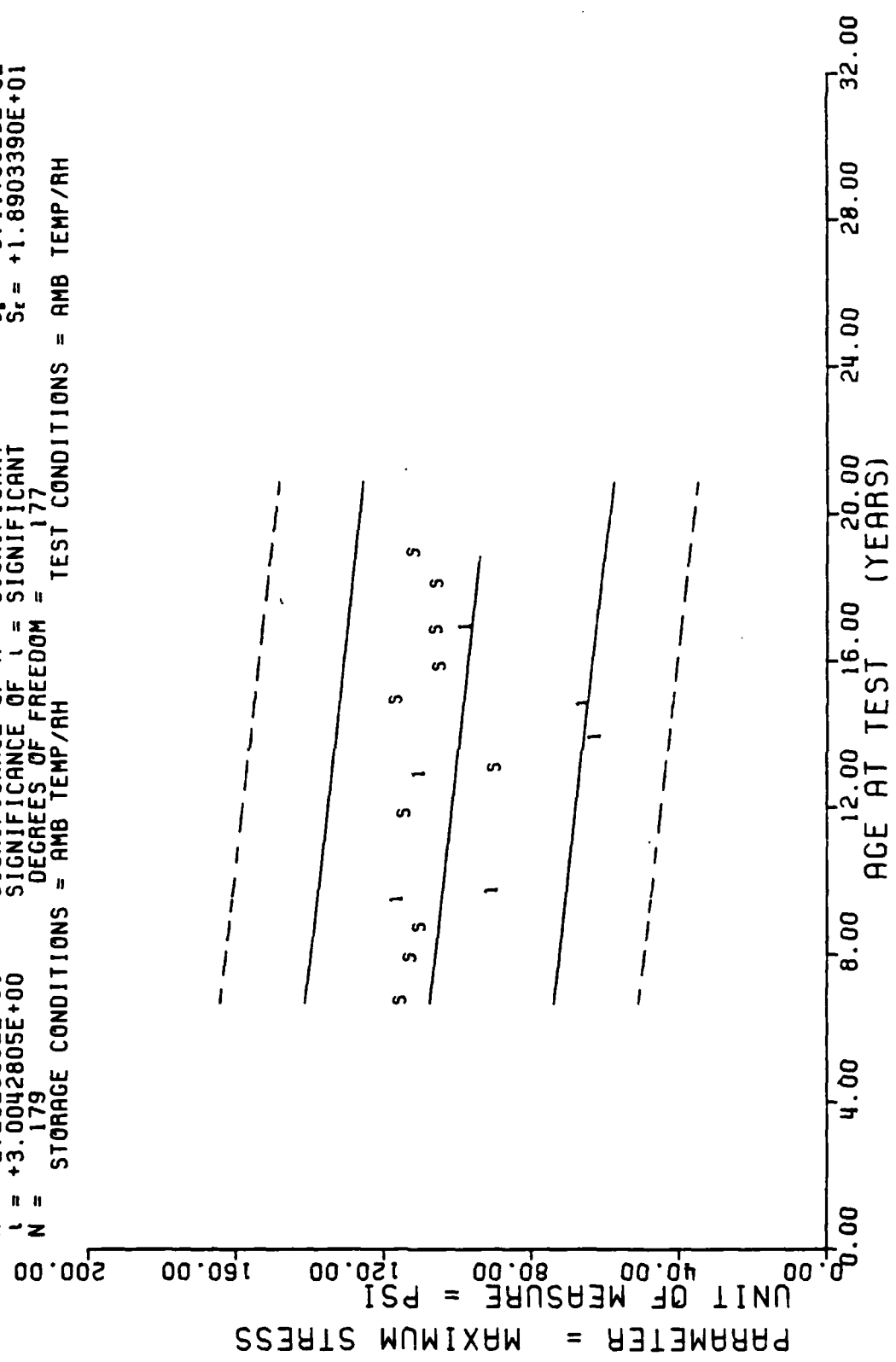
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|
| 80.0 | 27 |
| 94.0 | 2 |
| 104.0 | 10 |
| 113.0 | 12 |
| 116.0 | 12 |
| 141.0 | 11 |
| 154.0 | 9 |
| 156.0 | 22 |
| 166.0 | 9 |
| 177.0 | 10 |
| 178.0 | 8 |
| 189.0 | 11 |
| 201.0 | 12 |
| 202.0 | 4 |
| 216.0 | 10 |
| 226.0 | 10 |

CASEBOND TENSILE, STAGE 1 DISSECTED, CHS 0.2, CSA 0.75

This sample size summary is applicable to figure 21

$F = +9.0257016E+00$
 $R = -2.2026932E-01$
 $I = +3.0042805E+00$
 $N = 179$
 $Y = ((+1.1514611E+02) + (-9.3645013E-02) \times X)$
 SIGNIFICANCE OF F = SIGNIFICANT
 SIGNIFICANCE OF R = SIGNIFICANT
 SIGNIFICANCE OF I = SIGNIFICANT
 DEGREES OF FREEDOM = 177
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = AMB TEMP/RH



CASEBOND TENSILE, STAGE 1 DISSECTED, CHS 0.2, CSA 0.75

Figure 21

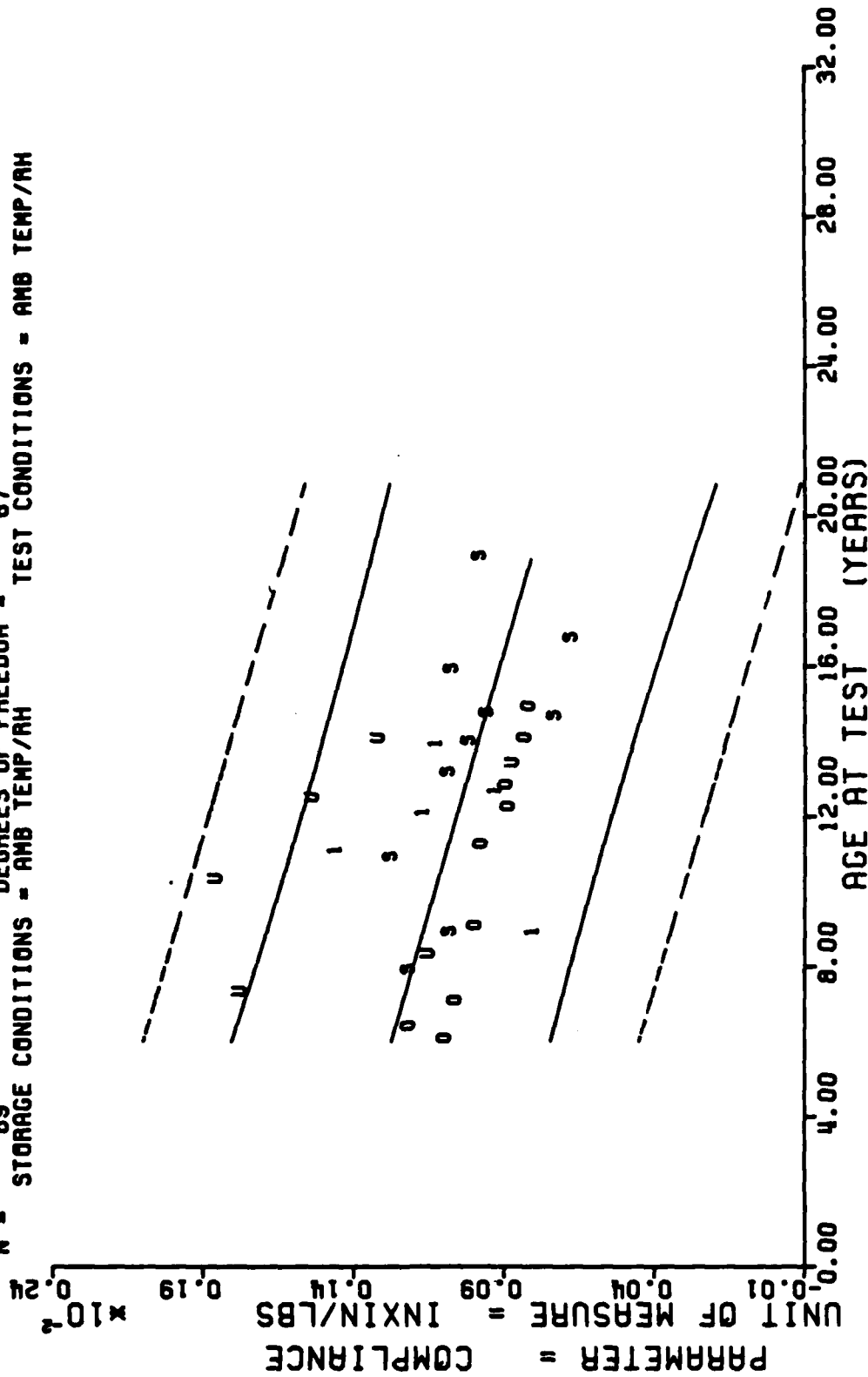
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 72.0 | 2 | 190.0 | 3 |
| 76.0 | 3 | 200.0 | 3 |
| 84.0 | 2 | 226.0 | 2 |
| 87.0 | 2 | | |
| 94.0 | 2 | | |
| 99.0 | 2 | | |
| 106.0 | 3 | | |
| 108.0 | 1 | | |
| 123.0 | 1 | | |
| 130.0 | 1 | | |
| 132.0 | 2 | | |
| 134.0 | 2 | | |
| 144.0 | 2 | | |
| 146.0 | 2 | | |
| 149.0 | 2 | | |
| 151.0 | 4 | | |
| 153.0 | 3 | | |
| 157.0 | 1 | | |
| 160.0 | 2 | | |
| 166.0 | 3 | | |
| 167.0 | 4 | | |
| 168.0 | 6 | | |
| 175.0 | 2 | | |
| 176.0 | 4 | | |
| 178.0 | 3 | | |

DISSECTED MURDER IP-H1011, CREEP 10 LB LOAD, COMPLIANCE AT 10 SEC.

This sample size summary is applicable to figures 22, 23 and 24

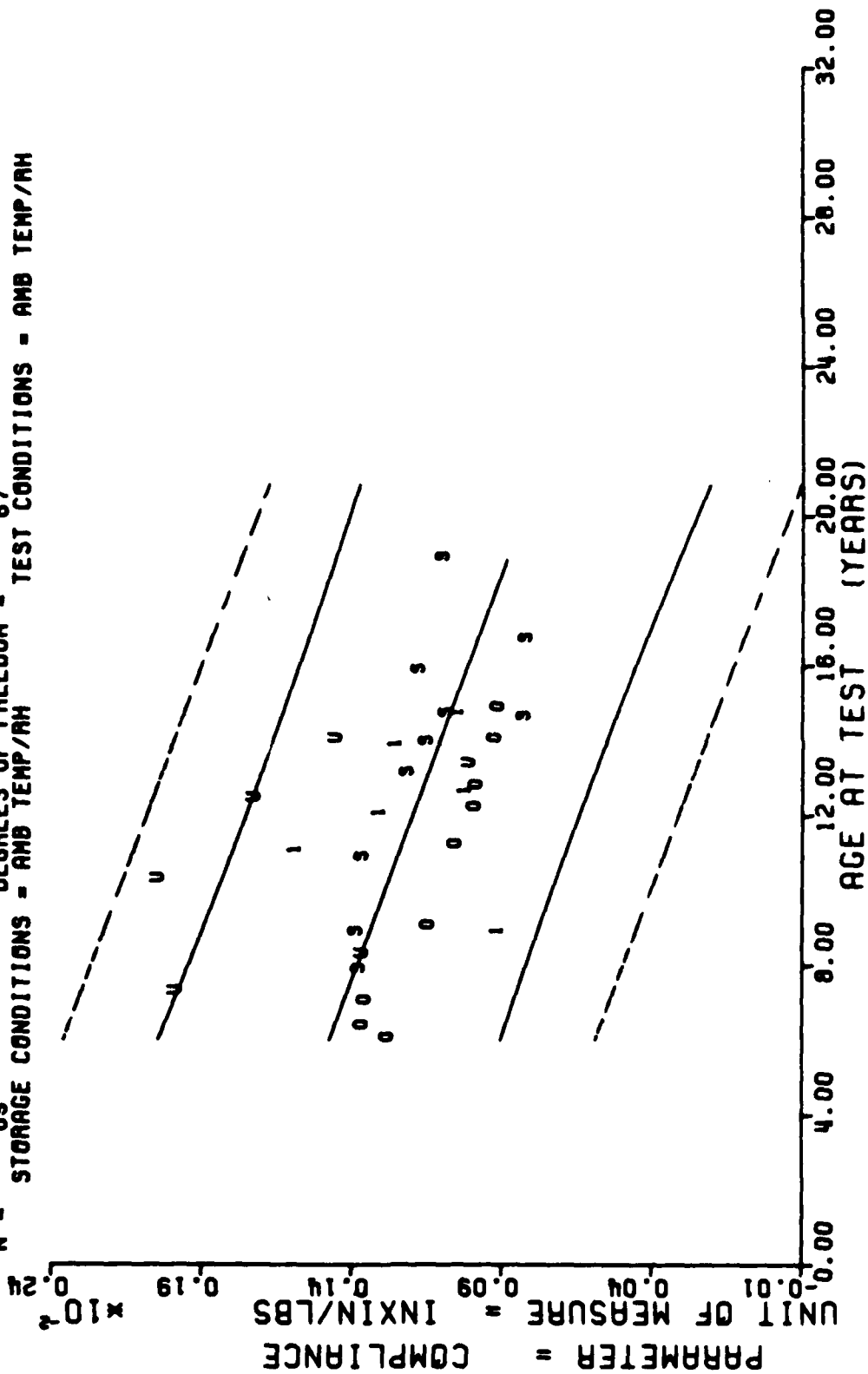
$F = +1.2110833E+01$ SIGNIFICANCE OF F = SIGNIFICANT $G_r = +2.9606196E-04$
 $R = -3.9126323E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_r = +8.6722309E-07$
 $t = +3.4800623E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_r = +2.7448529E-04$
 $N = 69$ DEGREES OF FREEDOM = 67 TEST CONDITIONS = AMB TEMP/AH
 STORAGE CONDITIONS = AMB TEMP/AH



DISSECTED MOTOR TP-H1011, CREEP 10 LB LOAD, COMPLIANCE AT 10 SEC.

Figure 22

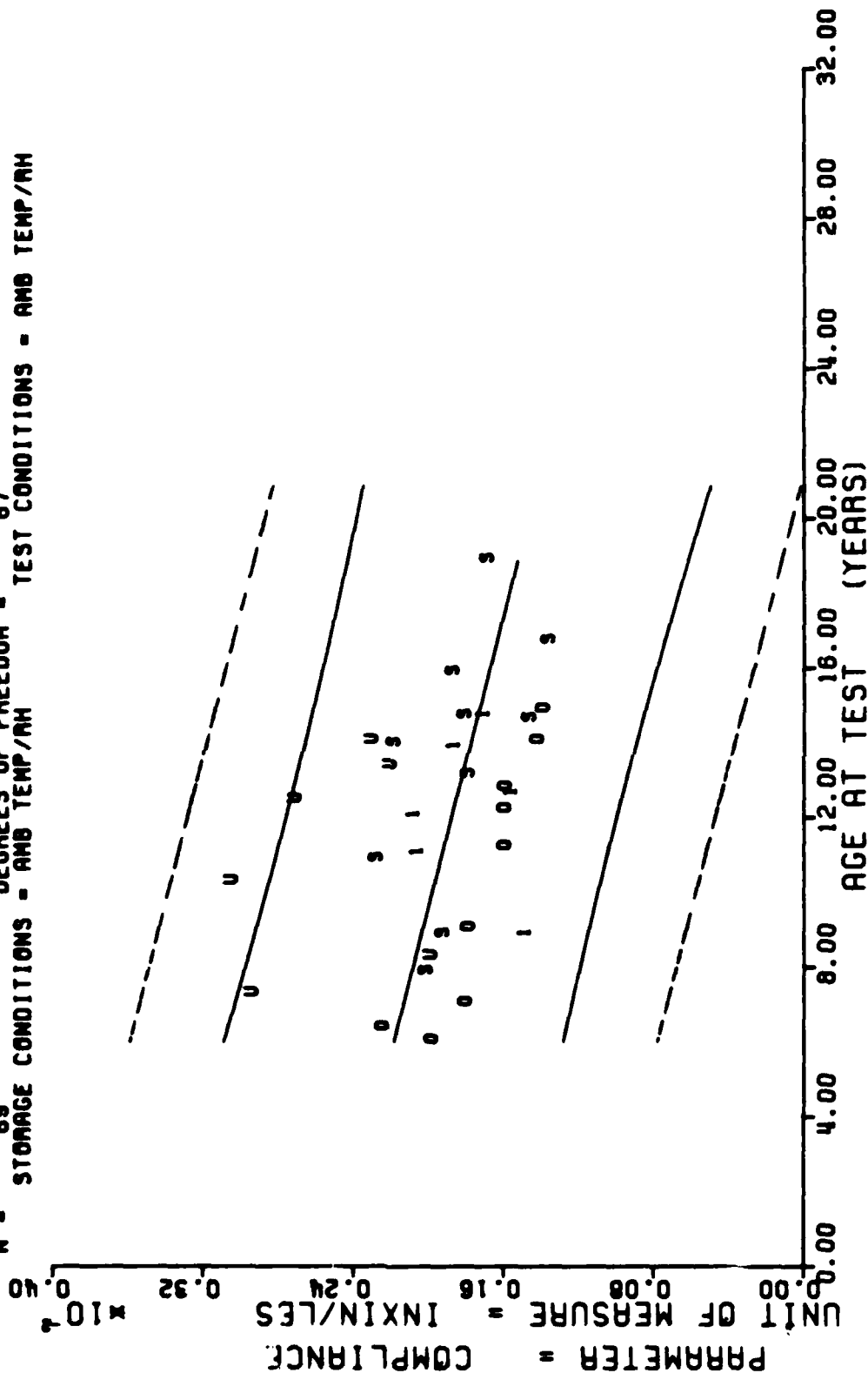
$F = +1.6948252E+01$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma = +3.2790280E-04$
 $R = -4.4932091E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_e = +9.3240694E-07$
 $t = +4.1168255E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_i = +2.9511667E-04$
 $N = 69$ DEGREES OF FREEDOM = 67
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



DISSECTED MOTOR TP-H1011, CREEP 10 LB LOAD, COMPLIANCE AT 20 SEC.

Figure 21

$F = +0.3752040E+00$ SIGNIFICANCE OF F = SIGNIFICANT $G_5 = +4.9282075E-04$
 $R = -3.3333694E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_0 = +1.4789072E-06$
 $I = +2.8939944E+00$ SIGNIFICANCE OF I = SIGNIFICANT $S_1 = +4.6808981E-04$
 $N = 69$ DEGREES OF FREEDOM = 67
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



DISSECTED MOTOR TP-H1011, CREEP 10 LB LOAD, COMPLIANCE AT 1000 SEC.

Figure 24

*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|
| 72.0 | 2 |
| 76.0 | 3 |
| 84.0 | 2 |
| 87.0 | 2 |
| 94.0 | 2 |
| 99.0 | 2 |
| 106.0 | 3 |
| 108.0 | 1 |
| 123.0 | 1 |
| 130.0 | 1 |
| 151.0 | 1 |
| 166.0 | 3 |
| 168.0 | 3 |
| 176.0 | 3 |
| 178.0 | 3 |
| 190.0 | 3 |
| 200.0 | 3 |
| 226.0 | 2 |

DISSECTED MOTOR TP-H1011, CREEP 10 LB LOAD, COMPLIANCE AT 10.000 SEC.

This sample size summary is applicable to figure 25

$F = +2.1478094E+01$ SIGNIFICANCE OF $F =$ SIGNIFICANT $\sigma_f = +6.3410566E-04$
 $R = -6.0092372E-01$ SIGNIFICANCE OF $R =$ SIGNIFICANT $S_o = +1.6955584E-06$
 $t = +4.6344464E+00$ SIGNIFICANCE OF $t =$ SIGNIFICANT $S_e = +5.1347040E-04$
 $N = 40$ DEGREES OF FREEDOM = 38 TEST CONDITIONS = AMB TEMP/RH
 STORAGE CONDITIONS = AMB TEMP/RH

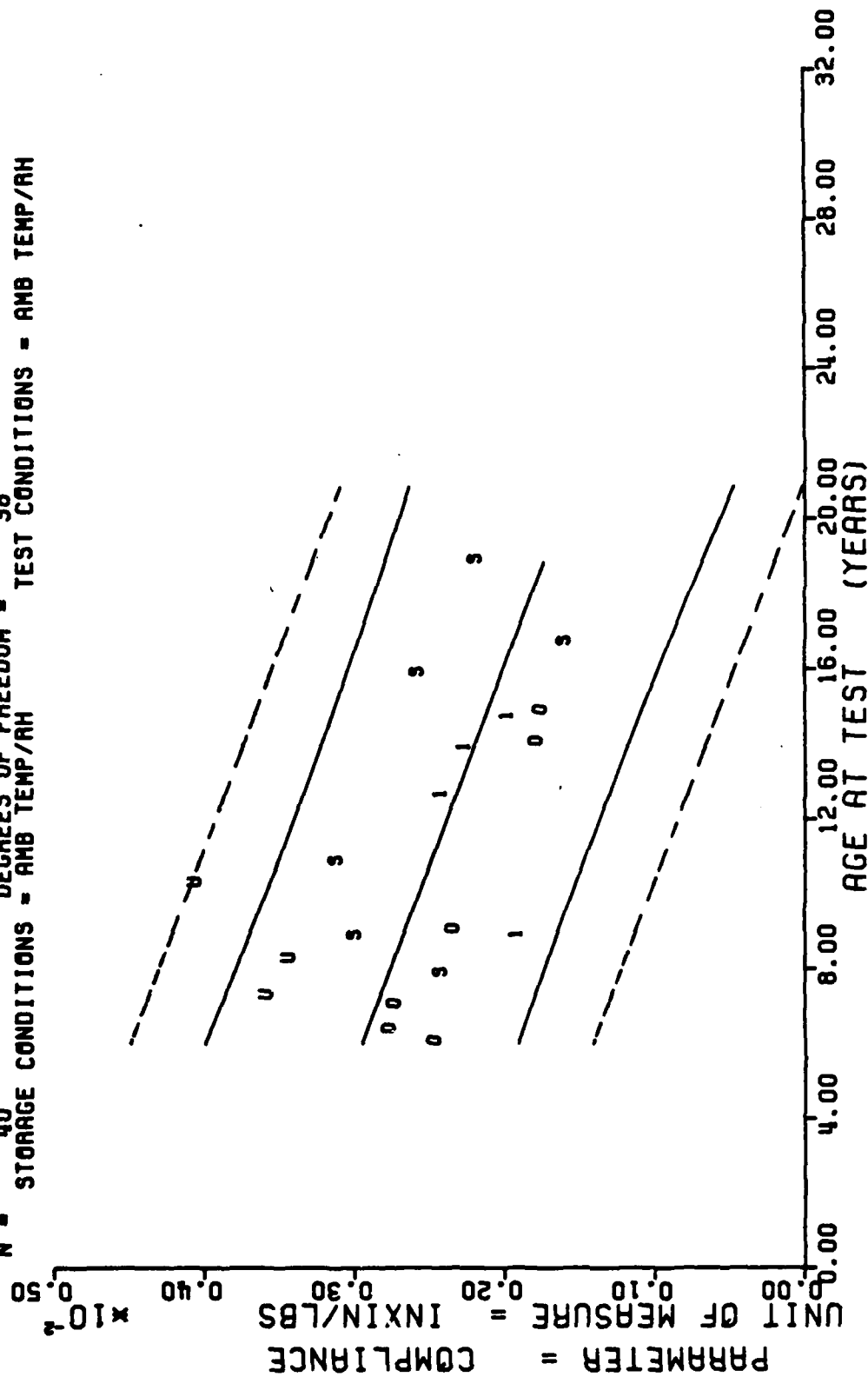


Figure 25

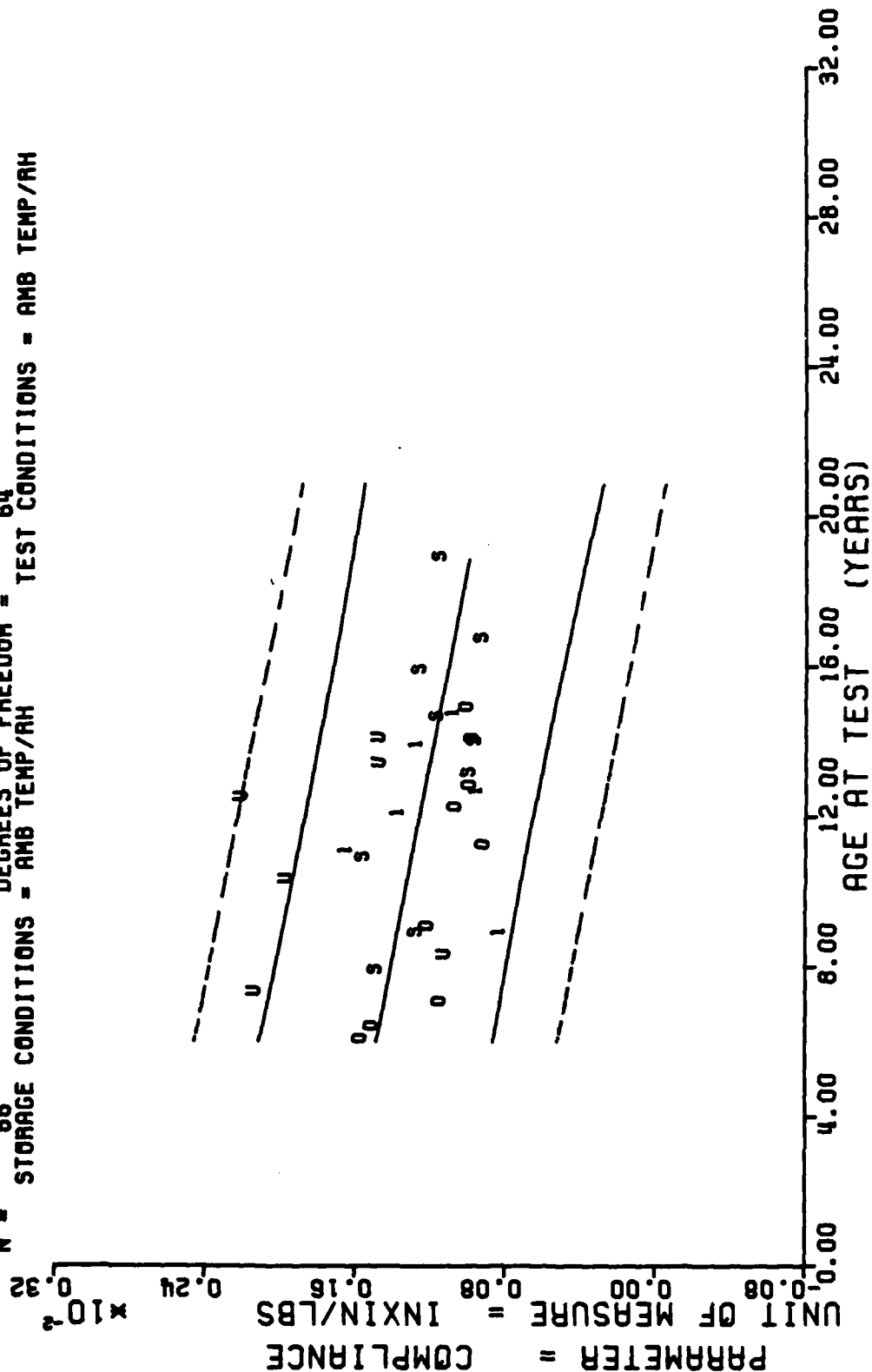
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 72.0 | 2 | 190.0 | 3 |
| 76.0 | 3 | 200.0 | 3 |
| 84.0 | 2 | 226.0 | 4 |
| 87.0 | 2 | | |
| 94.0 | 2 | | |
| 99.0 | 2 | | |
| 106.0 | 3 | | |
| 108.0 | 1 | | |
| 123.0 | 1 | | |
| 130.0 | 1 | | |
| 132.0 | 2 | | |
| 134.0 | 2 | | |
| 144.0 | 2 | | |
| 146.0 | 2 | | |
| 149.0 | 2 | | |
| 151.0 | 2 | | |
| 153.0 | 3 | | |
| 157.0 | 2 | | |
| 160.0 | 2 | | |
| 166.0 | 3 | | |
| 167.0 | 1 | | |
| 168.0 | 6 | | |
| 175.0 | 2 | | |
| 176.0 | 3 | | |
| 178.0 | 3 | | |

DISSECTED MOTOR TF-H1011, CREEP 12 LB LOAD, COMPLIANCE AT 10 SEC.

This sample size summary is applicable to figures 26, 27 and 28

$Y = ((+1.7167943E-03) + (-3.2052169E-06) \times X)$
 $F = +1.0939234E+01$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_t = +3.4616863E-04$
 $A = -3.8206639E-01$ SIGNIFICANCE OF A = SIGNIFICANT $S_t = +9.6908967E-07$
 $t = +3.3074513E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_t = +3.2239609E-04$
 $N = 66$ DEGREES OF FREEDOM = 64
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



DISSECTED MOTOR TP-H1011, CREEP 12 LB LOAD, COMPLIANCE AT 10 SEC.

Figure 26

$Y = ((+2.0040371E-03) + (-3.9994304E-06) \times X)$
 $F = +1.3708638E+01$ SIGNIFICANCE OF F = SIGNIFICANT $S_F = +3.9292056E-04$
 $R = -4.2001279E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_R = +1.0801920E-06$
 $t = +3.7025179E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_t = +3.5935756E-04$
 $N = 66$ DEGREES OF FREEDOM = 64
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

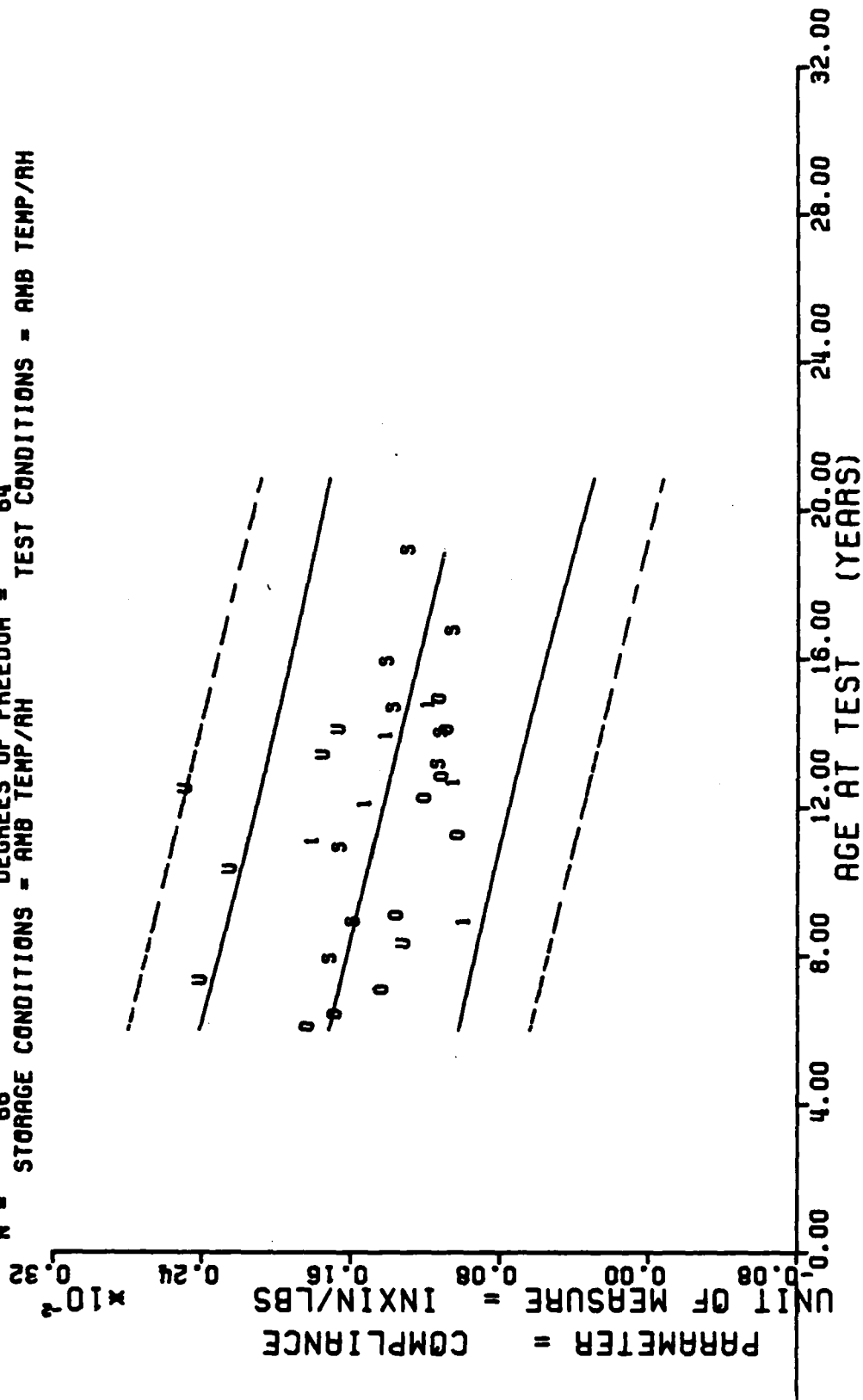
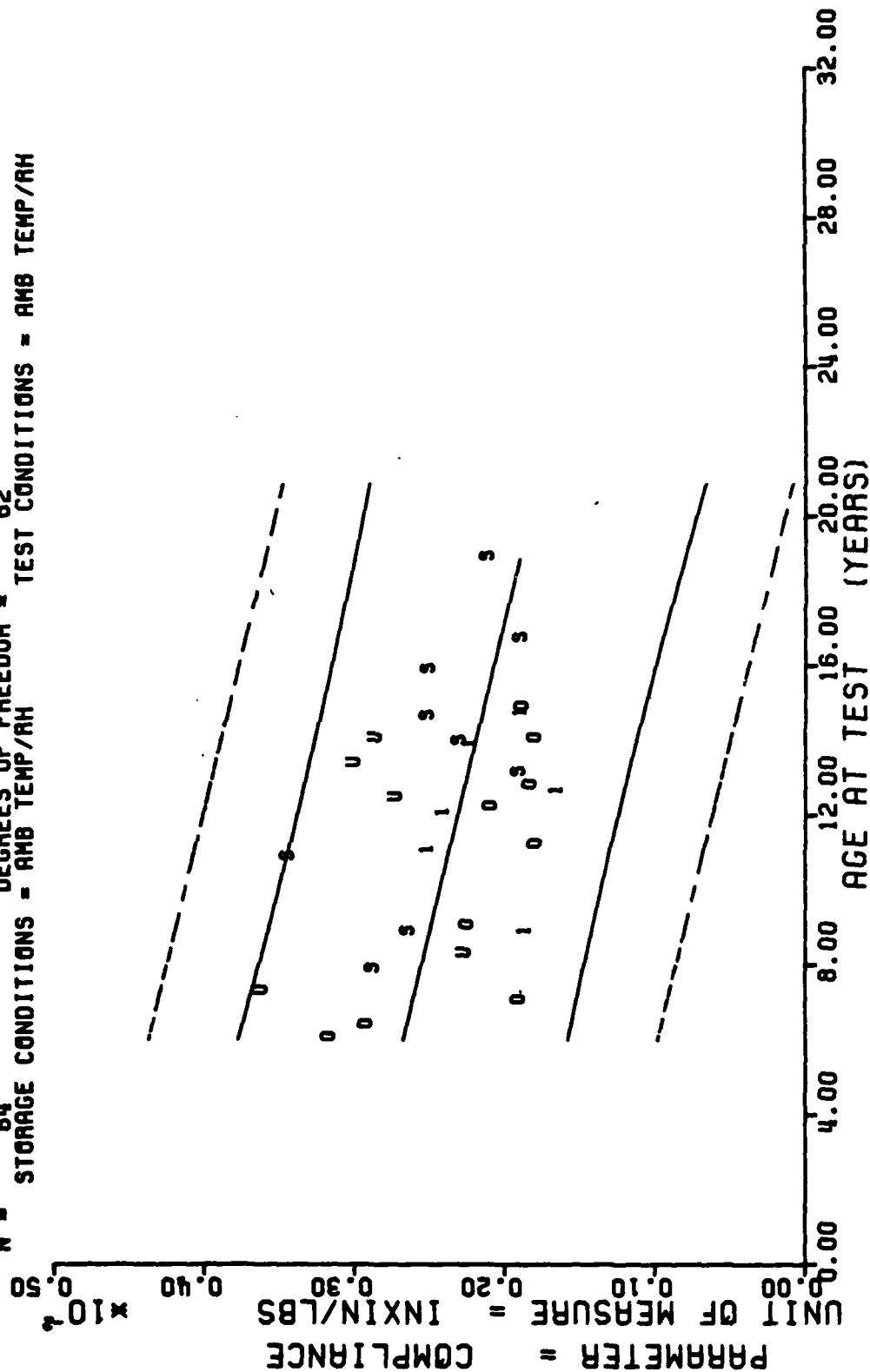


Figure 27

$F = +8.4940509E+00$ SIGNIFICANCE OF F = SIGNIFICANT $G_1 = +5.9777296E-04$
 $R = -3.4712124E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_1 = +1.7334159E-06$
 $t = +2.9144555E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_2 = +5.6510650E-04$
 $N = 64$ DEGREES OF FREEDOM = 62 TEST CONDITIONS = AMB TEMP/RH
 STORAGE CONDITIONS = AMB TEMP/RH



DISSECTED MOTOR TP-H1011, CREEP 12 LB LOAD, COMPLIANCE AT 1000 SEC.

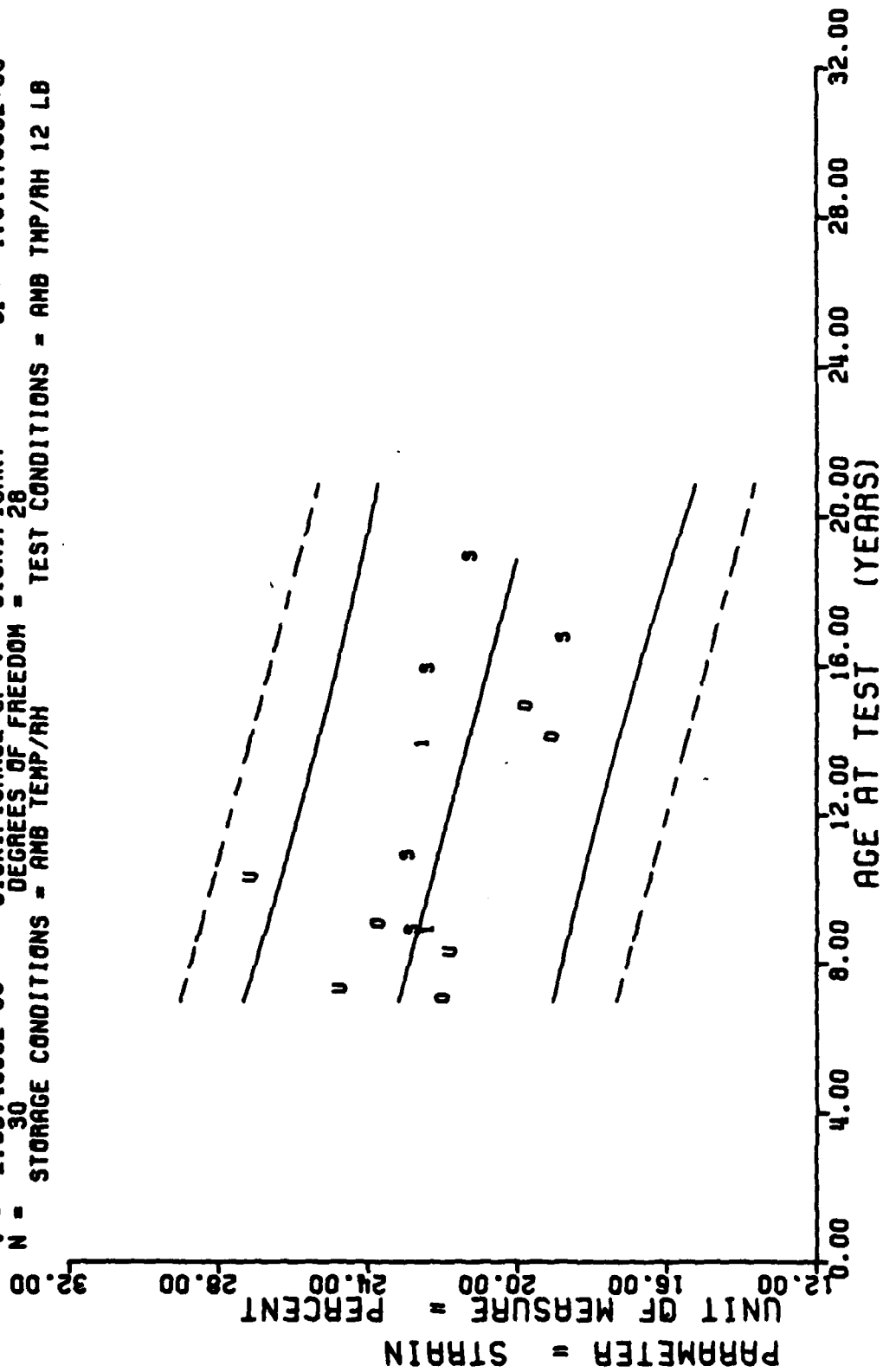
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|
| 84.0 | 2 |
| 87.0 | 2 |
| 99.0 | 2 |
| 106.0 | 3 |
| 108.0 | 1 |
| 123.0 | 1 |
| 130.0 | 1 |
| 166.0 | 3 |
| 168.0 | 3 |
| 178.0 | 2 |
| 190.0 | 3 |
| 200.0 | 3 |
| 226.0 | 4 |

TP-H1011 DISSECTED MOTORS. CREEP, X STRAIN AT RUPTURE, 12 LB LOAD

This sample size summary is applicable to figure 29

$F = +8.9251521E+00$ SIGNIFICANCE OF F = SIGNIFICANT $S_1 = +2.1944967E+00$
 $R = -4.9163938E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_2 = +7.4303927E-03$
 $t = +2.9874993E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_3 = +1.9447903E+00$
 $N = 30$ DEGREES OF FREEDOM = 28
 $Y = ((+2.5034808E+01) + (-2.2198293E-02) * X)$ TEST CONDITIONS = AMB TMP/AM 12 LB
 Y = STORAGE CONDITIONS = AMB TEMP/AM



TP-H1011 DISSECTED MOTORS, CREEP, X STRAIN AT RUPTURE, 12 LB LOAD

*** SAMPLE SIZE SUMMARY ***

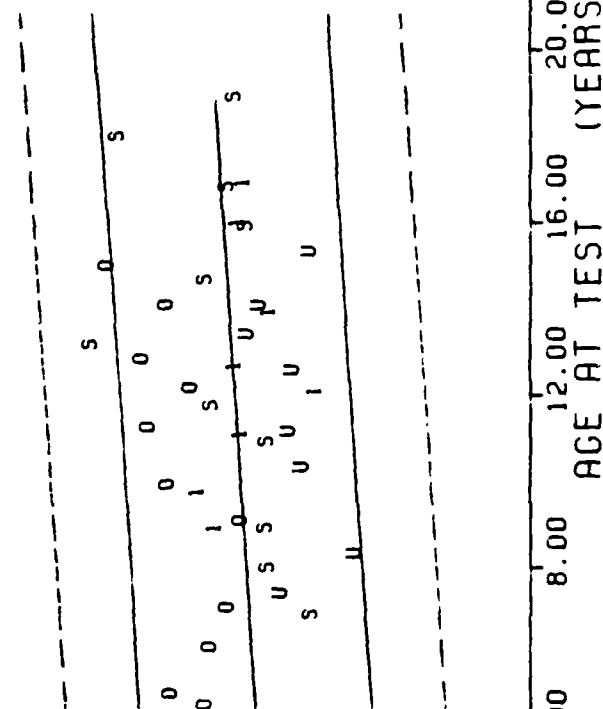
| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 57.0 | 3 | 166.0 | 3 |
| 60.0 | 3 | 168.0 | 9 |
| 73.0 | 3 | 175.0 | 3 |
| 82.0 | 3 | 179.0 | 3 |
| 84.0 | 3 | 183.0 | 3 |
| 88.0 | 3 | 190.0 | 3 |
| 95.0 | 4 | 191.0 | 3 |
| 99.0 | 3 | 201.0 | 3 |
| 106.0 | 6 | 202.0 | 3 |
| 108.0 | 3 | 215.0 | 3 |
| 116.0 | 3 | 226.0 | 3 |
| 118.0 | 3 | | |
| 123.0 | 3 | | |
| 130.0 | 3 | | |
| 132.0 | 3 | | |
| 133.0 | 3 | | |
| 134.0 | 3 | | |
| 140.0 | 3 | | |
| 144.0 | 4 | | |
| 145.0 | 3 | | |
| 150.0 | 3 | | |
| 151.0 | 3 | | |
| 153.0 | 3 | | |
| 157.0 | 3 | | |
| 160.0 | 3 | | |

TP-H1011 DISSECTED MTRS. STRESS RELAXATION MODULUS, 3 PERCENT STRAIN, 10 SEC

This sample size summary is applicable to figures 30 thru 33

Y = ((+6.0574963E+02) + (+5.3679689E-01) * X)
 F = +2.8487511E+00 SIGNIFICANCE OF F = NOT SIGNIFICANT $\sigma_f = +1.4764804E+02$
 R = +1.5417377E-01 SIGNIFICANCE OF R = NOT SIGNIFICANT $S_r = +3.1804073E-01$
 I = +1.6878243E+00 SIGNIFICANCE OF I = NOT SIGNIFICANT $S_i = +1.4650482E+02$
 N = 119 DEGREES OF FREEDOM = 117
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

PARAMETER = STRESS RELAX MODULUS
 UNIT OF MEASURE = PSI
 *10¹



TP-M1011 DISSECTED MTRS. STRESS RELAXATION MODULUS, 3 PERCENT STRAIN, 10 SEC

Figure 30

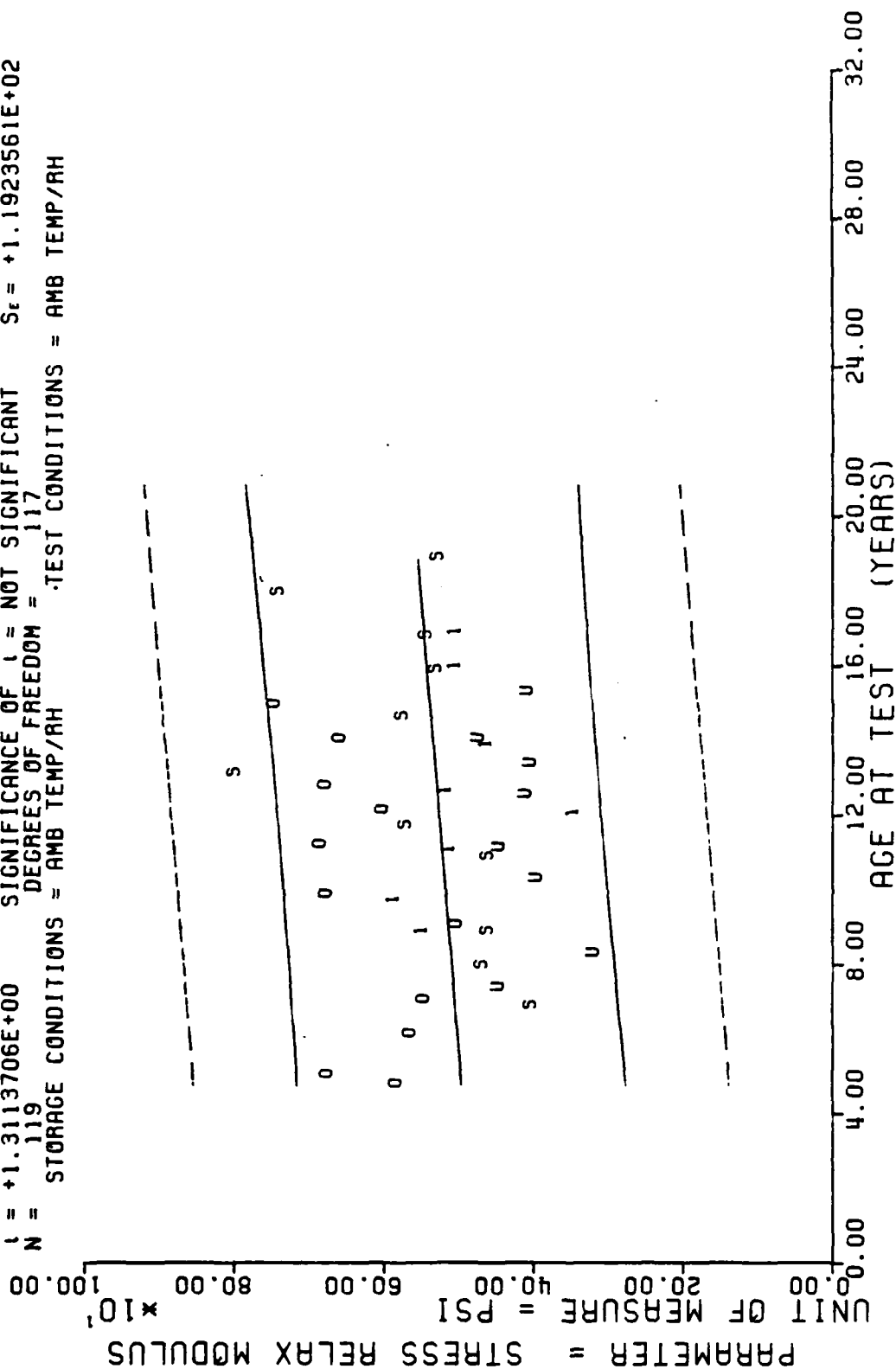
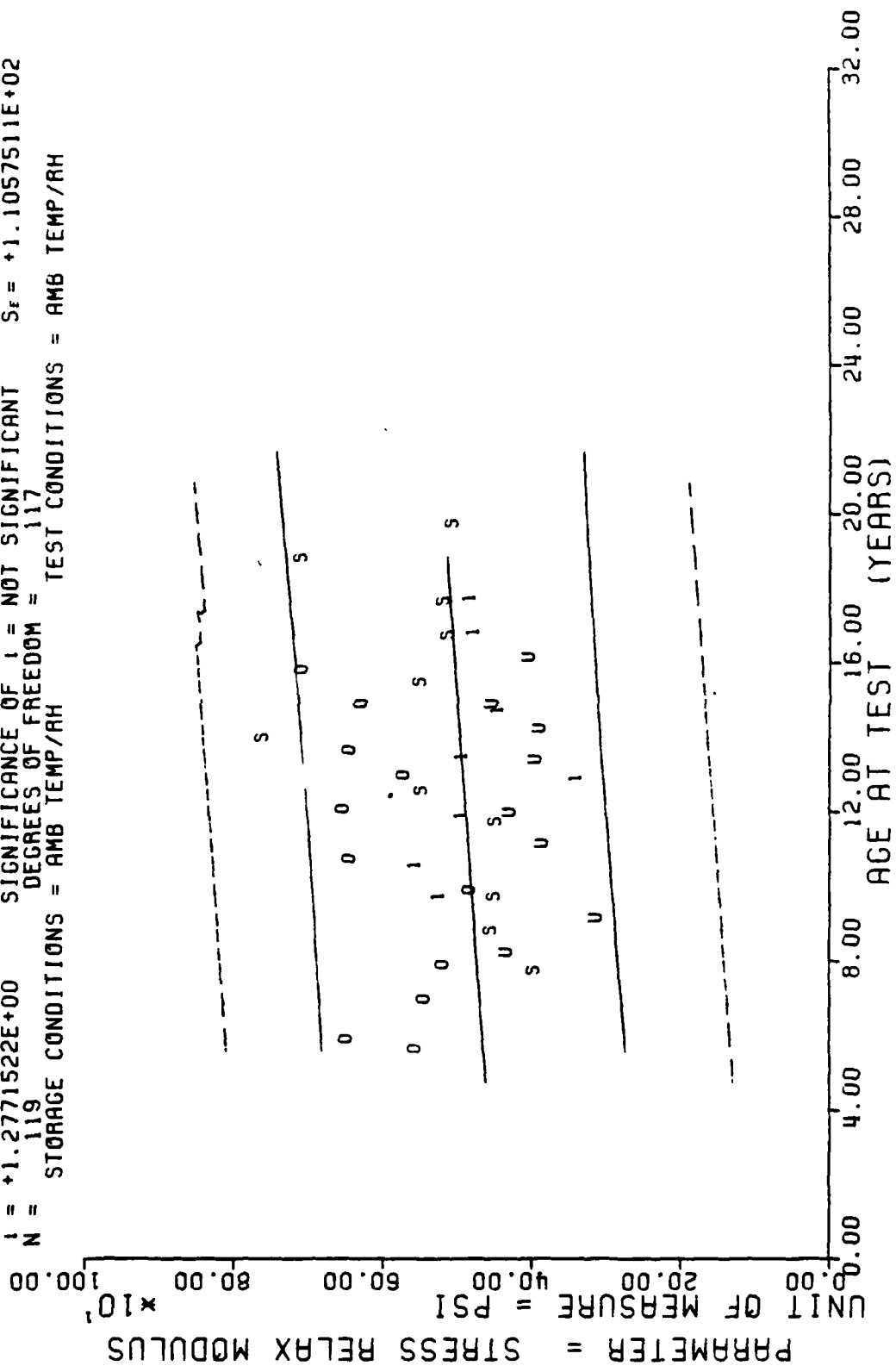
[illegible]

Figure 31

$Y = ((+4.4359145E+02) + (+3.0657087E-01) * X)$
 $F = +1.6311179E+00$ SIGNIFICANCE OF F = NOT SIGNIFICANT $G_1 = +1.1087042E+02$
 $R = +1.1725824E-01$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_1 = +2.4004253E-01$
 $I = +1.2771522E+00$ SIGNIFICANCE OF I = NOT SIGNIFICANT $S_2 = +1.1057511E+02$
 $N = 119$ DEGREES OF FREEDOM = 117
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



TP-H1011 DISSECTED MTRs. STRESS RELAXATION MODULUS. 3 PERCENT STRAIN. 100 SEC

Figure 32

PARAMETER = STRESS RELAX MODULUS
UNIT OF MEASURE = PSI
*10¹

AGE AT TEST (YEARS)

0.00 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00

0.00 20.00 40.00 60.00 80.00 100.00

1 = +8.9963048E-01
N = 116
SIGNIFICANCE OF t = NOT SIGNIFICANT
DEGREES OF FREEDOM = 114
S_t = +9.087274/E+01
STORAGE CONDITIONS = AMB TEMP/AH
TEST CONDITIONS = AMB TEMP/AH

HTP-H1011 DISSECTED MTAS. STRESS RELAXATION MODULUS, 3 PERCENT STRAIN, 1000 SEC

Figure 33

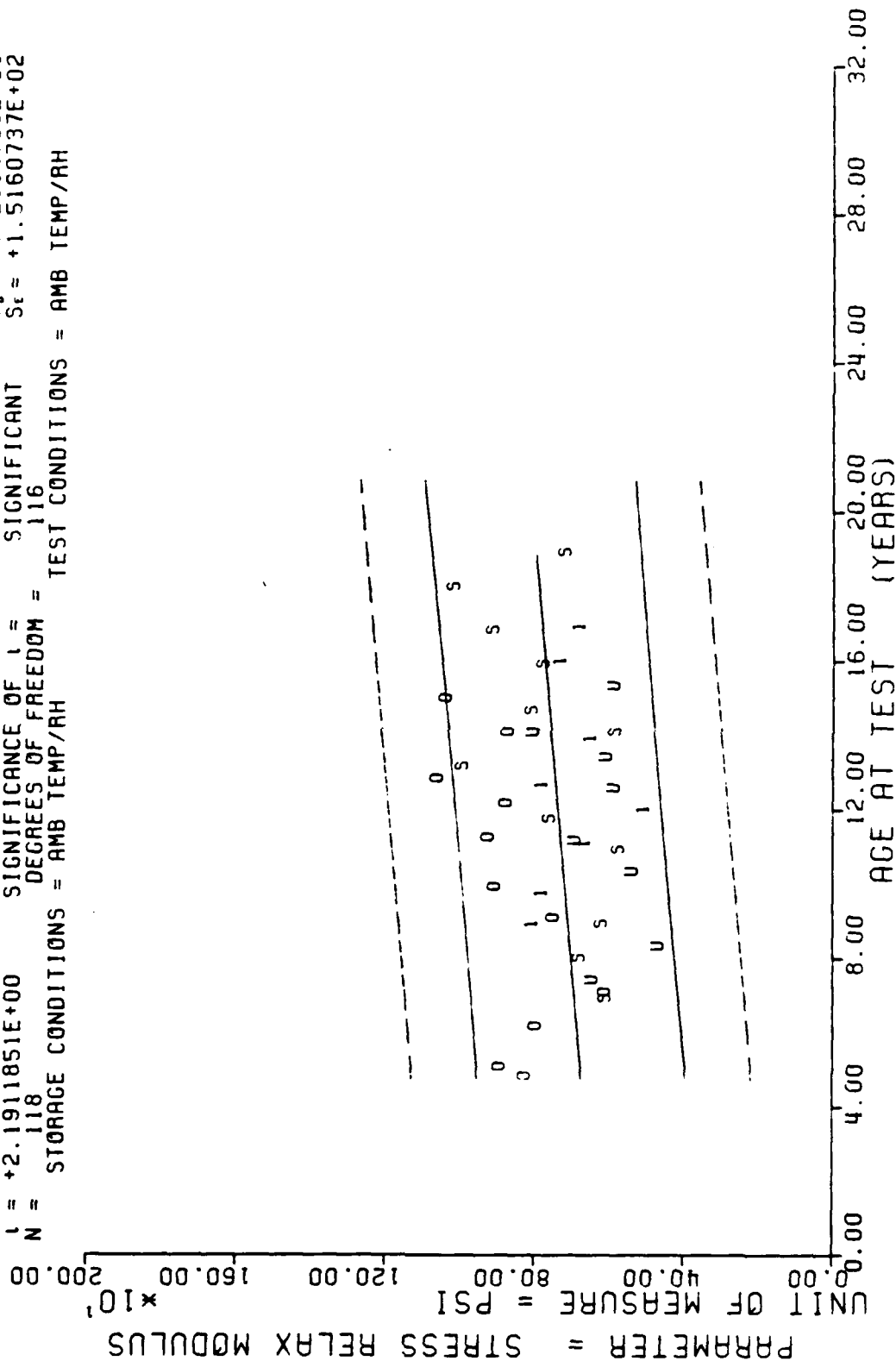
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 57.0 | 3 | 166.0 | 3 |
| 60.0 | 3 | 168.0 | 9 |
| 73.0 | 3 | 175.0 | 3 |
| 82.0 | 3 | 179.0 | 3 |
| 84.0 | 3 | 183.0 | 3 |
| 88.0 | 3 | 190.0 | 3 |
| 95.0 | 4 | 191.0 | 3 |
| 99.0 | 3 | 201.0 | 3 |
| 106.0 | 6 | 202.0 | 3 |
| 108.0 | 3 | 215.0 | 3 |
| 116.0 | 3 | 226.0 | 3 |
| 118.0 | 3 | | |
| 123.0 | 3 | | |
| 130.0 | 3 | | |
| 132.0 | 3 | | |
| 133.0 | 3 | | |
| 134.0 | 3 | | |
| 140.0 | 3 | | |
| 143.0 | 3 | | |
| 145.0 | 3 | | |
| 150.0 | 3 | | |
| 151.0 | 3 | | |
| 153.0 | 3 | | |
| 157.0 | 3 | | |
| 160.0 | 3 | | |

TP-H1011 DISSECTED MTPS. STRESS RELAXATION MODULUS. 5 PERCENT STRAIN. 10 SEC

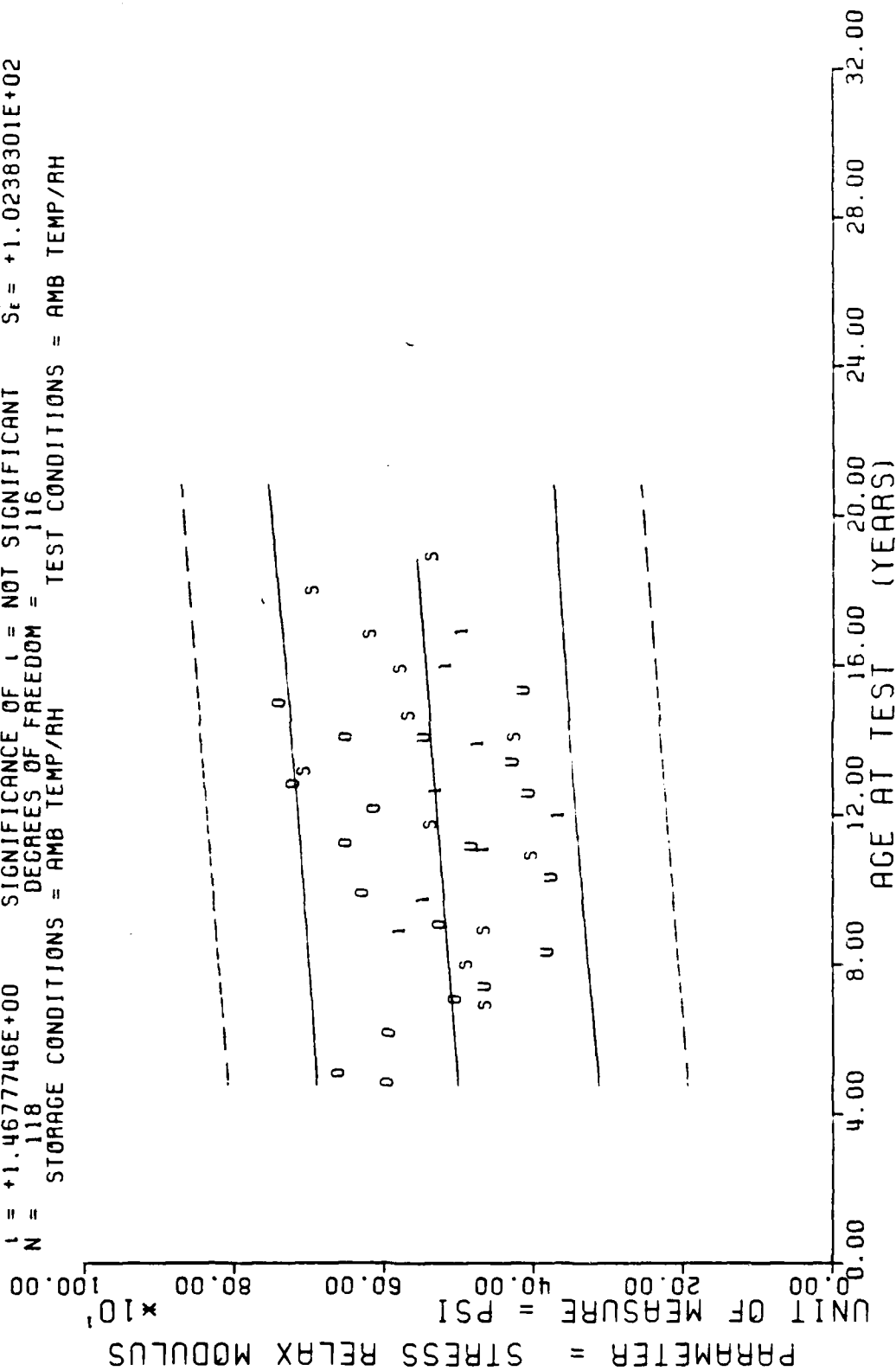
This sample size summary is applicable to figures 34 thru 37

$F = +4.8012925E+00$ SIGNIFICANCE OF $F =$ SIGNIFICANT $G_r = +1.5405052E+02$
 $R = +1.9936241E-01$ SIGNIFICANCE OF $R =$ SIGNIFICANT $S_o = +3.2914599E-01$
 $I = +2.1911851E+00$ SIGNIFICANCE OF $I =$ SIGNIFICANT $S_t = +1.5160737E+02$
 $N = 118$ DEGREES OF FREEDOM = 116
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



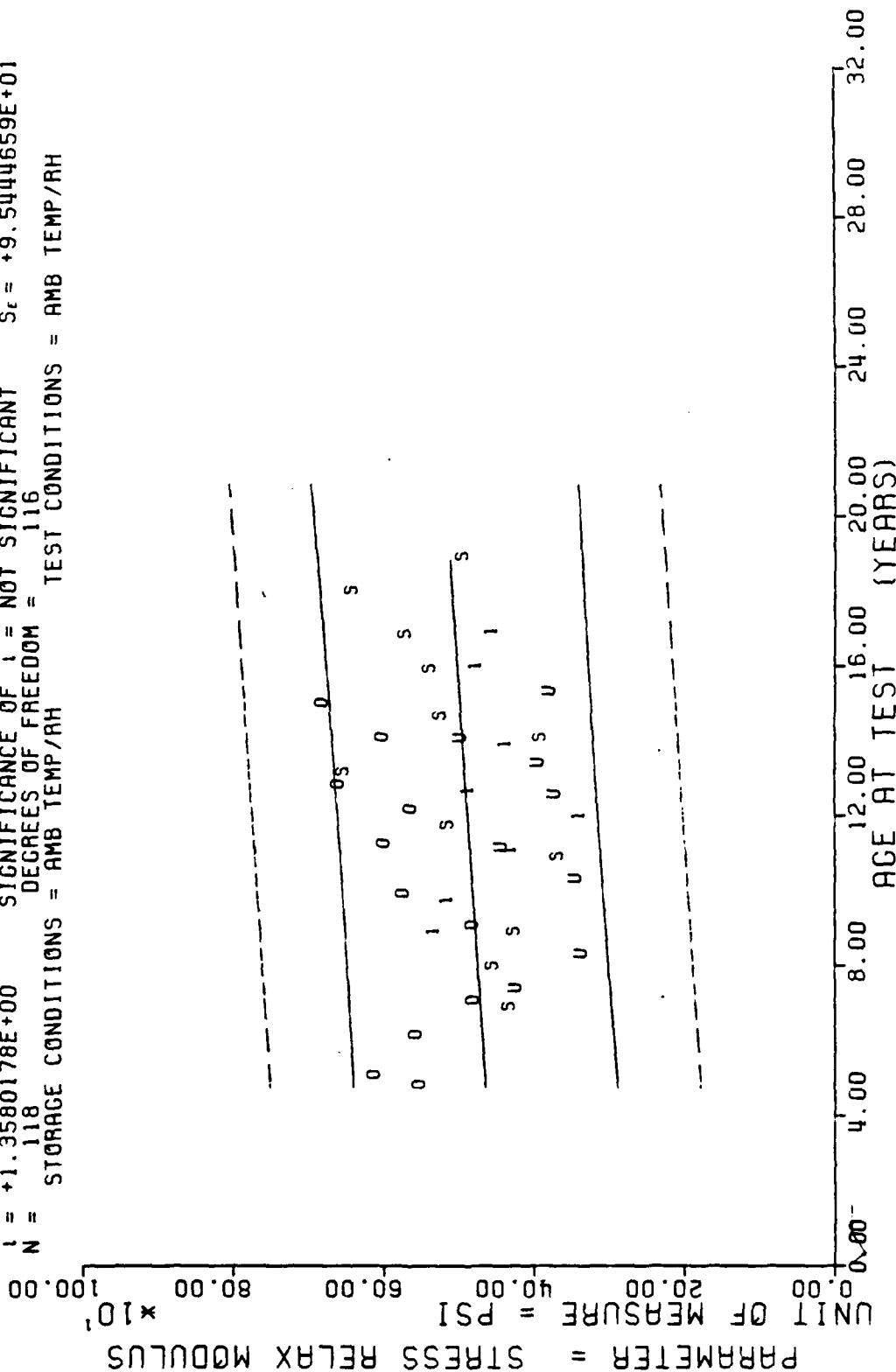
TP-H1011 DISSECTED MTRS. STRESS RELAXATION MODULUS, 5 PERCENT STRAIN, 10 SEC

$Y = ((+4.8205328E+02) + (+3.2625377E-01) \times X)$
 $F = +2.1543623E+00$ SIGNIFICANCE OF F = NOT SIGNIFICANT $\sigma_t = +1.0288684E+02$
 $R = +1.3503131E-01$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_o = +2.2227783E-01$
 $t = +1.467746E+00$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_t = +1.0238301E+02$
 $N = 118$ DEGREES OF FREEDOM = 116
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



TP-H1011 DISSECTED MTRs, STRESS RELAXATION MODULUS, 5 PERCENT STRAIN, 50 SEC

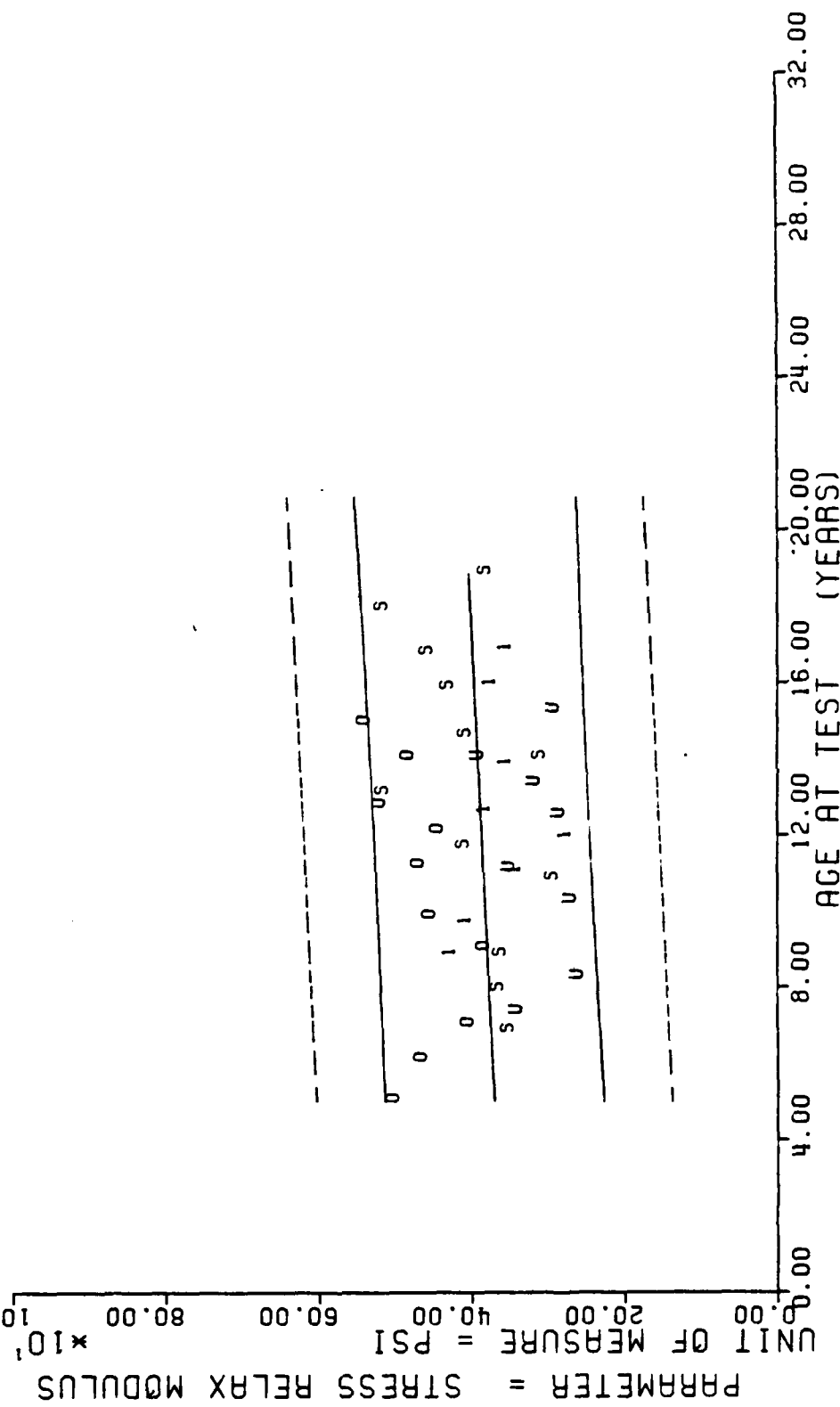
$Y = \dots (+4.4807846E+02) + (+2.8140082E-01) \times X$
 $F = +1.8442126E+00$ SIGNIFICANCE OF F = NOT SIGNIFICANT $\sigma_1 = +9.5788380E+01$
 $R = +1.2509828E-01$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_0 = +2.0721437E-01$
 $I = +1.3580178E+00$ SIGNIFICANCE OF I = NOT SIGNIFICANT $S_2 = +9.5444659E+01$
 $N = 118$ DEGREES OF FREEDOM = 116
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



TP-H1011 DISSECTED MTRS. STRESS RELAXATION MODULUS, 5 PERCENT STRAIN, 100 SEC

Figure 36

F = +1.1986055E+00
 R = +1.0244900E-01
 I = +1.0948084E+00
 N = 115
 Y = ((+3.5864634E+02) + (+1.9436482E-01) * X)
 SIGNIFICANCE OF F = NOT SIGNIFICANT
 SIGNIFICANCE OF R = NOT SIGNIFICANT
 SIGNIFICANCE OF I = NOT SIGNIFICANT
 DEGREES OF FREEDOM = 113
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = AMB TEMP/RH



TP-H1011 DISSECTED MTRS, STRESS RELAXATION MODULUS, 5 PERCENT STRAIN, 1000 SEC

Figure 37

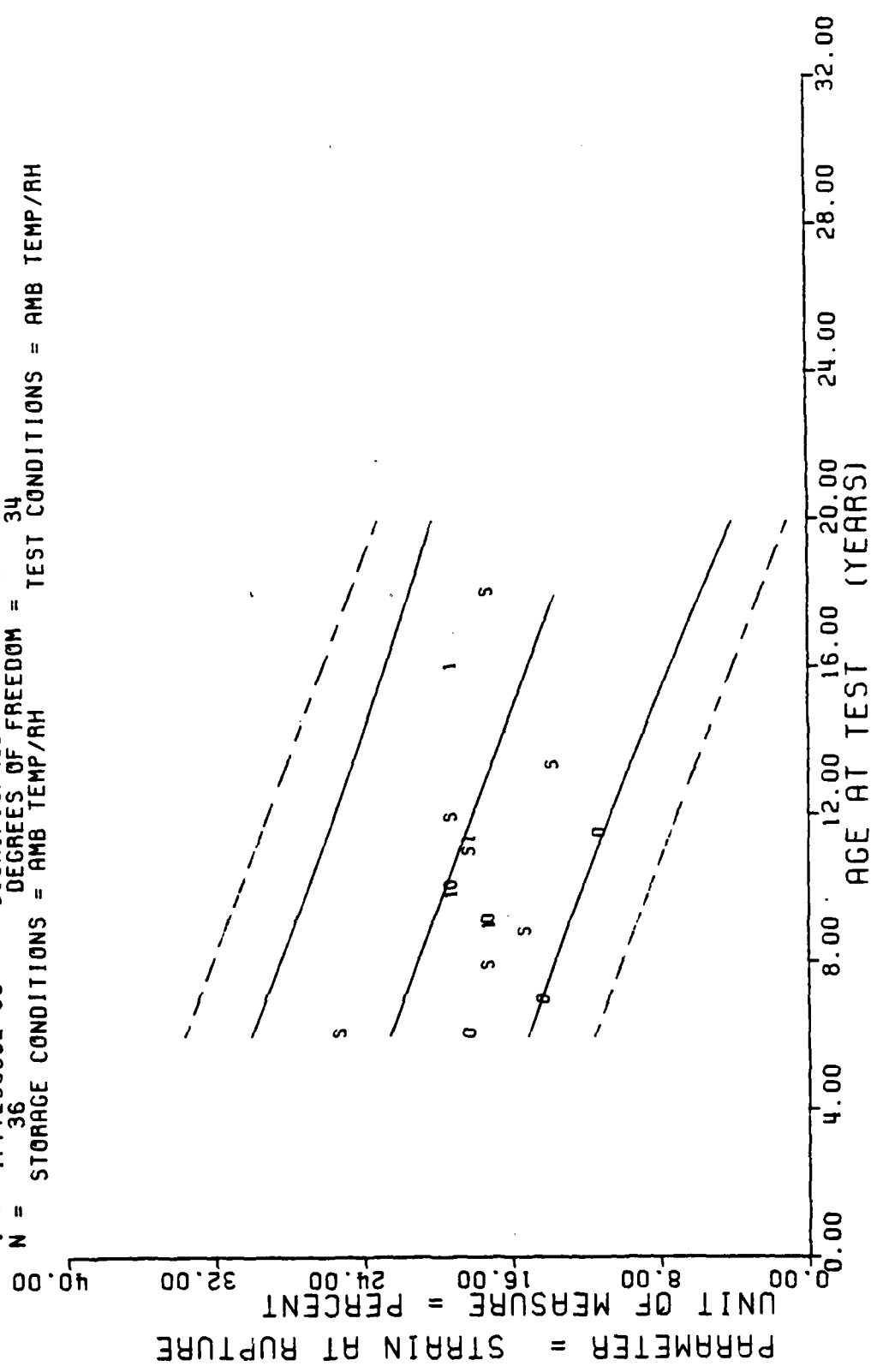
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|
| 72.0 | 16 |
| 83.0 | 1 |
| 94.0 | 1 |
| 105.0 | 1 |
| 107.0 | 1 |
| 109.0 | 1 |
| 117.0 | 1 |
| 120.0 | 1 |
| 131.0 | 1 |
| 135.0 | 2 |
| 137.0 | 2 |
| 142.0 | 1 |
| 159.0 | 2 |
| 191.0 | 2 |
| 215.0 | 3 |

STAGE 1 DSCTD MPS. CCNSTANT STRAIN, STRAIN 0.1 INIT AND 0.01 EVERY 48 HRS

This sample size summary is applicable to figure 38

$Y = .1(+2.7087033E+01) + (-6.2517465E-02) * X$
 $F = +2.2775769E+01$ SIGNIFICANCE OF F = SIGNIFICANT $G = +4.6961652E+00$
 $R = -6.3336639E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_0 = +1.3099805E-02$
 $I = +4.7723966E+00$ SIGNIFICANCE OF I = SIGNIFICANT $S_e = +3.6871930E+00$
 $N = 36$ DEGREES OF FREEDOM = 34
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1 OSSCLO MTRS. CONSTANT STRAIN, STRAIN 0.1 INIT AND 0.01 EVERY 48 HRS

Figure 38

*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 71.0 | 6 | 175.0 | 5 |
| 82.0 | 5 | 178.0 | 10 |
| 86.0 | 6 | 183.0 | 10 |
| 93.0 | 1 | 188.0 | 10 |
| 97.0 | 5 | 189.0 | 10 |
| 104.0 | 5 | 192.0 | 50 |
| 105.0 | 5 | 202.0 | 10 |
| 107.0 | 5 | 216.0 | 50 |
| 115.0 | 5 | 226.0 | 10 |
| 117.0 | 5 | | |
| 122.0 | 5 | | |
| 130.0 | 5 | | |
| 132.0 | 10 | | |
| 134.0 | 5 | | |
| 140.0 | 5 | | |
| 143.0 | 3 | | |
| 145.0 | 3 | | |
| 149.0 | 5 | | |
| 150.0 | 5 | | |
| 152.0 | 5 | | |
| 156.0 | 5 | | |
| 160.0 | 3 | | |
| 164.0 | 10 | | |
| 167.0 | 3 | | |
| 168.0 | 20 | | |

STAGE 1 DISSECTED MTRS. SHORE A HARDNESS, 10 SECOND

This sample size summary is applicable to figure 39

$F = +2.0214987E-02$ SIGNIFICANCE OF F = NOT SIGNIFICANT $\sigma_f = +3.4022486E+00$
 $R = +8.1677218E-03$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_e = +4.8131682E-03$
 $t = +1.4217942E-01$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_t = +3.4077446E+00$
 $N = 305$ DEGREES OF FREEDOM = 303
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

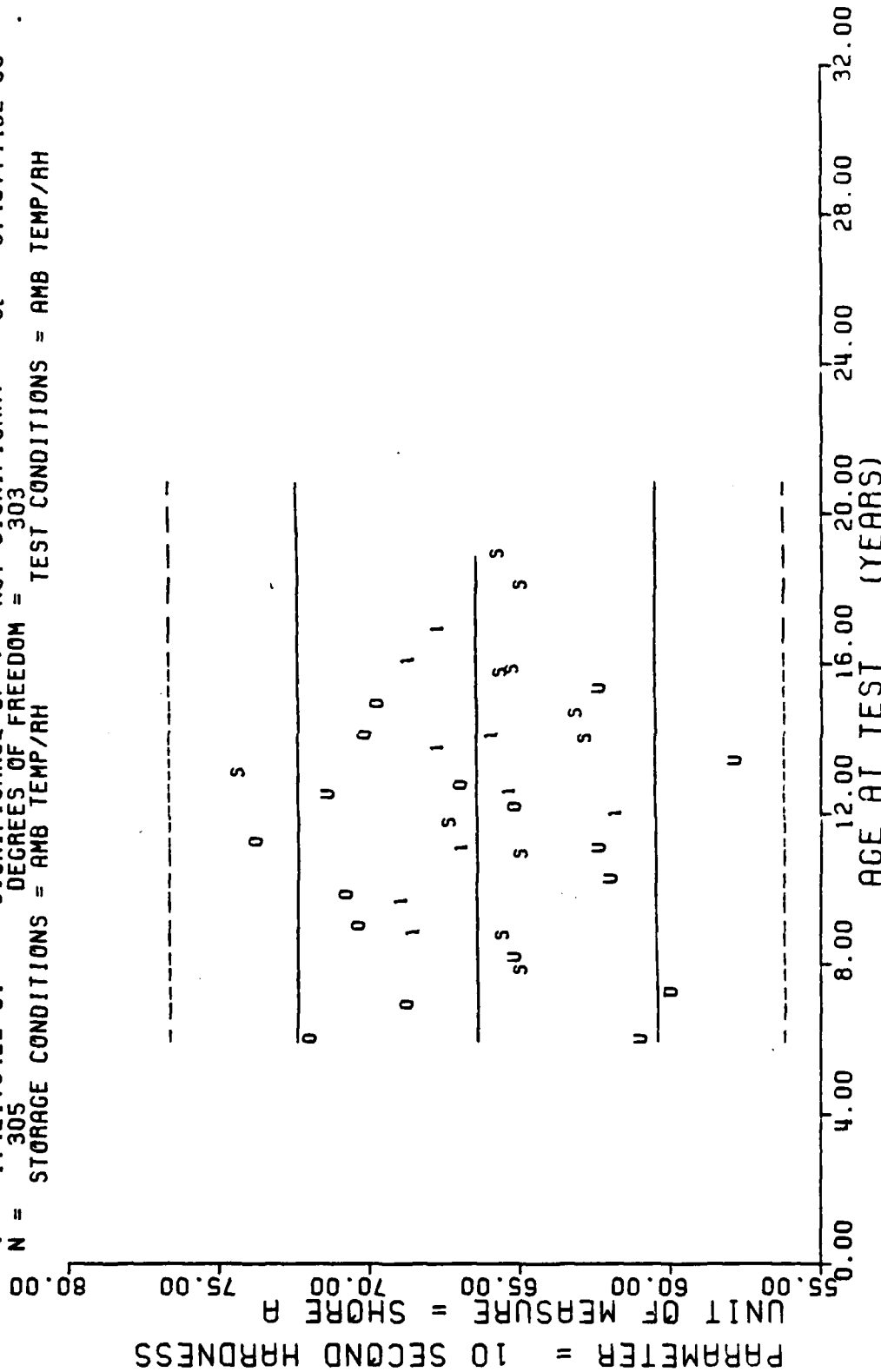


Figure 39

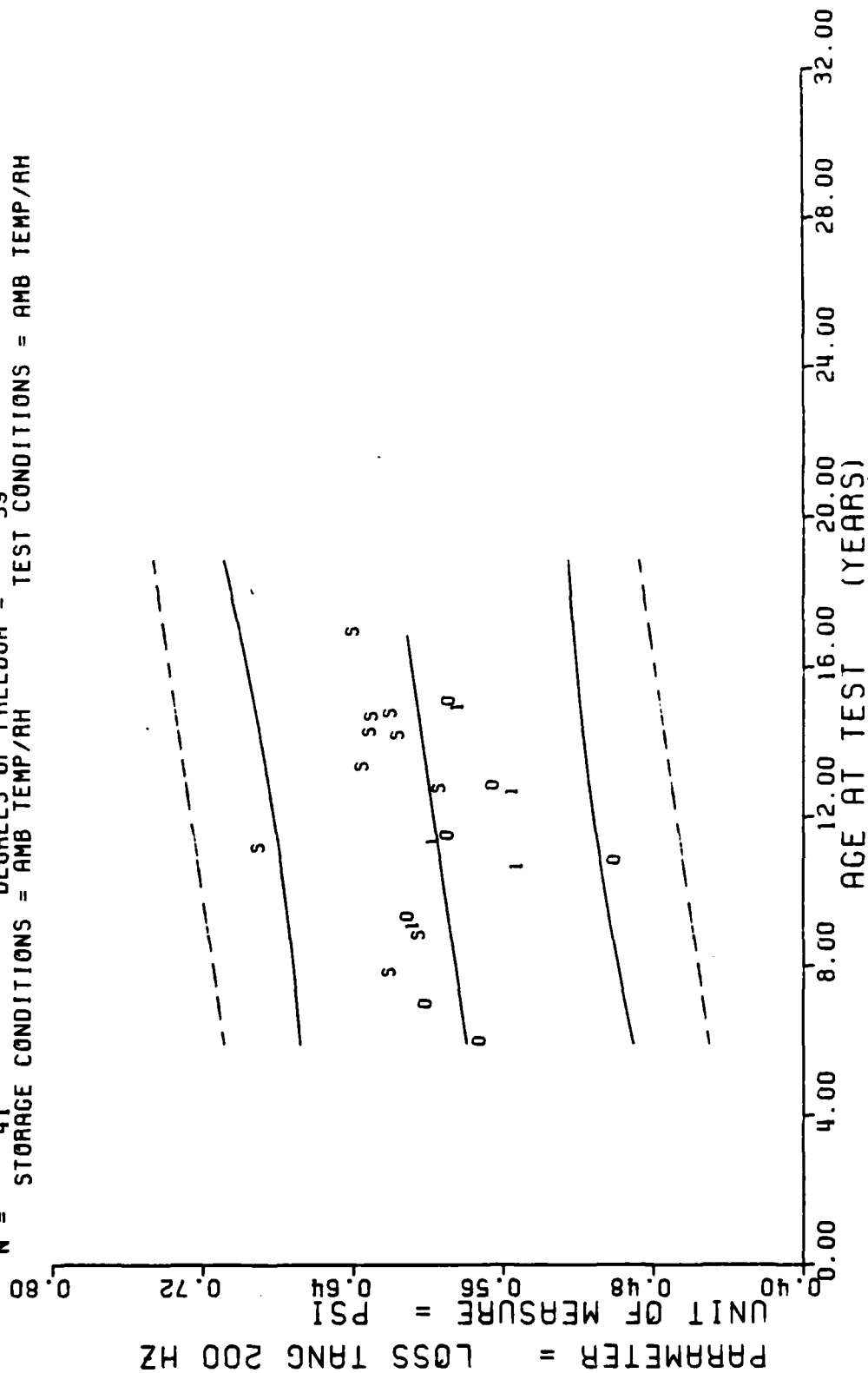
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|
| 71.0 | 2 |
| 83.0 | 2 |
| 93.0 | 1 |
| 105.0 | 2 |
| 108.0 | 2 |
| 111.0 | 2 |
| 127.0 | 2 |
| 129.0 | 2 |
| 133.0 | 2 |
| 135.0 | 3 |
| 137.0 | 2 |
| 151.0 | 2 |
| 152.0 | 2 |
| 153.0 | 2 |
| 159.0 | 2 |
| 169.0 | 1 |
| 170.0 | 2 |
| 175.0 | 1 |
| 176.0 | 1 |
| 178.0 | 2 |
| 180.0 | 1 |
| 202.0 | 2 |

STAGE I DISSECTED MOTICRS, DYNAMIC RESPONSE, CENTER-WY 70 GM, STOR SHEAR AT 200 HZ

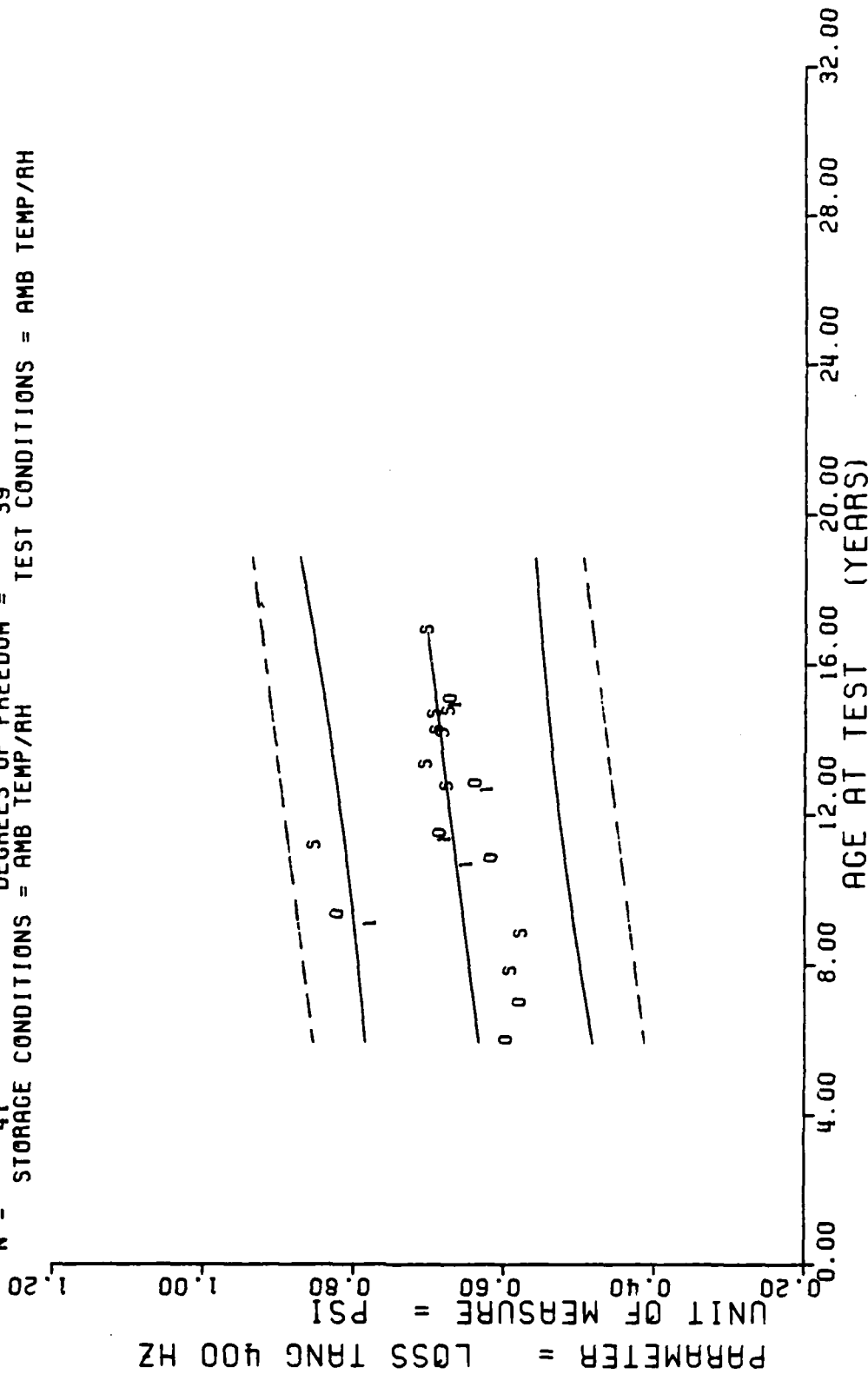
This sample size summary is applicable to figures 40 thru 43

$Y = ((+5.6207916E-01) + (+2.4108331E-04) \times X)$
 $F = +1.5183324E+00$ SIGNIFICANCE OF F = NOT SIGNIFICANT $\sigma_f = +4.3338176E-02$
 $R = +1.9357873E-01$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_e = +1.9565174E-04$
 $I = +1.2322063E+00$ SIGNIFICANCE OF I = NOT SIGNIFICANT $S_e = +4.3060081E-02$
 $N = 41$ DEGREES OF FREEDOM = 39
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE I DISSECTED MOTORS. DYNAMIC RESPONSE. CENTER-WT 70 GM. LOSS TANG AT 200 HZ

$Y = ((+5.9568513E-01) + (+5.2736034E-04) * X)$
 $F = +2.4992484E+00$ SIGNIFICANCE OF F = NOT SIGNIFICANT $G_1 = +7.4779749E-02$
 $R = +2.4540567E-01$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_0 = +3.3358211E-04$
 $I = +1.5809011E+00$ SIGNIFICANCE OF I = NOT SIGNIFICANT $S_t = +7.3416535E-02$
 $N = 41$ DEGREES OF FREEDOM = 39
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



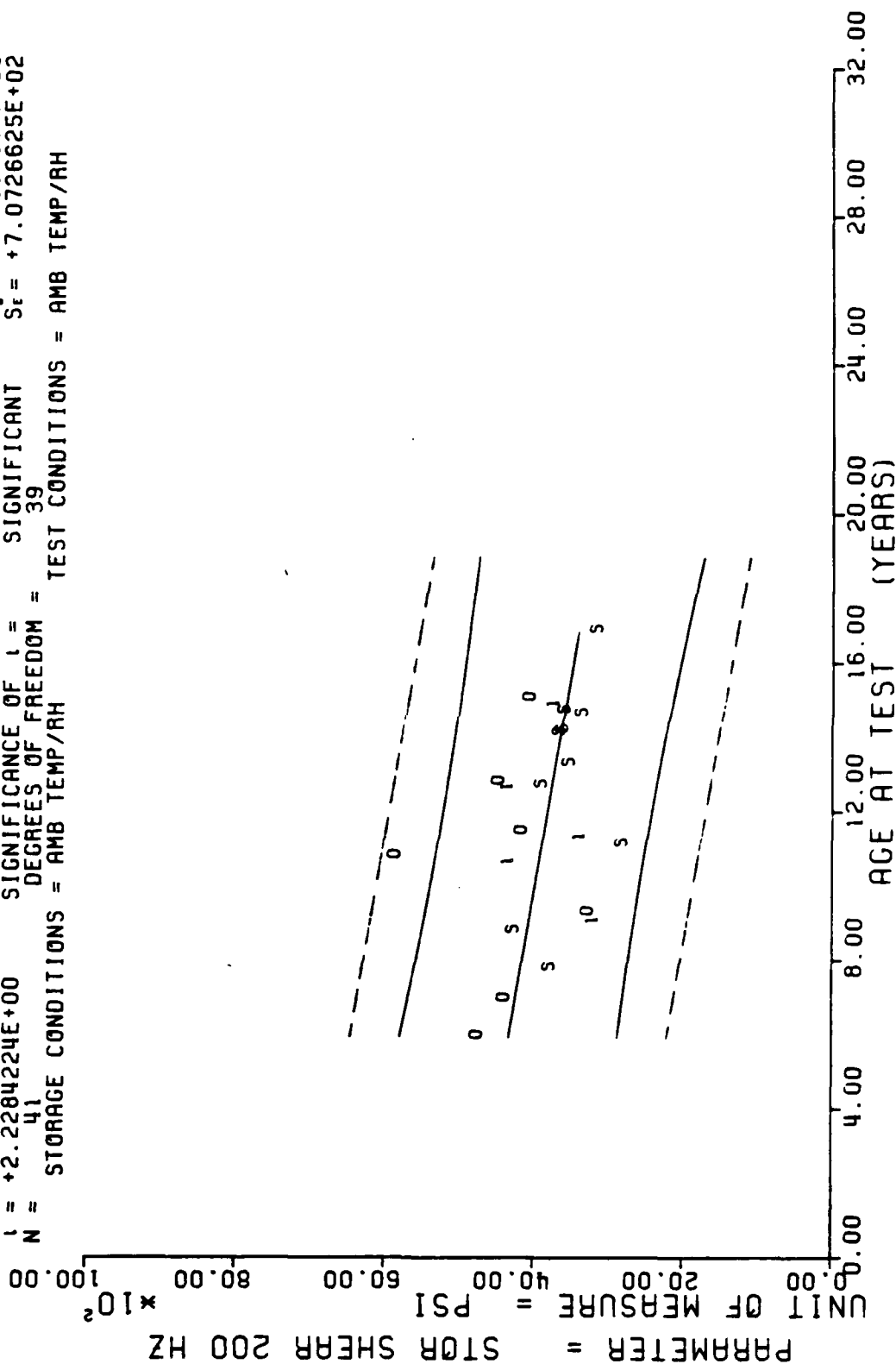
STAGE I DISSECTED MOTORS.DYNAMIC RESPONSE.CENTER-WT 70 GM.LOSS TANG AT 400 HZ

Figure 41

$F = +4.9658665E+00$
 $R = -3.3607770E-01$
 $t = +2.2284224E+00$
 $N = 41$

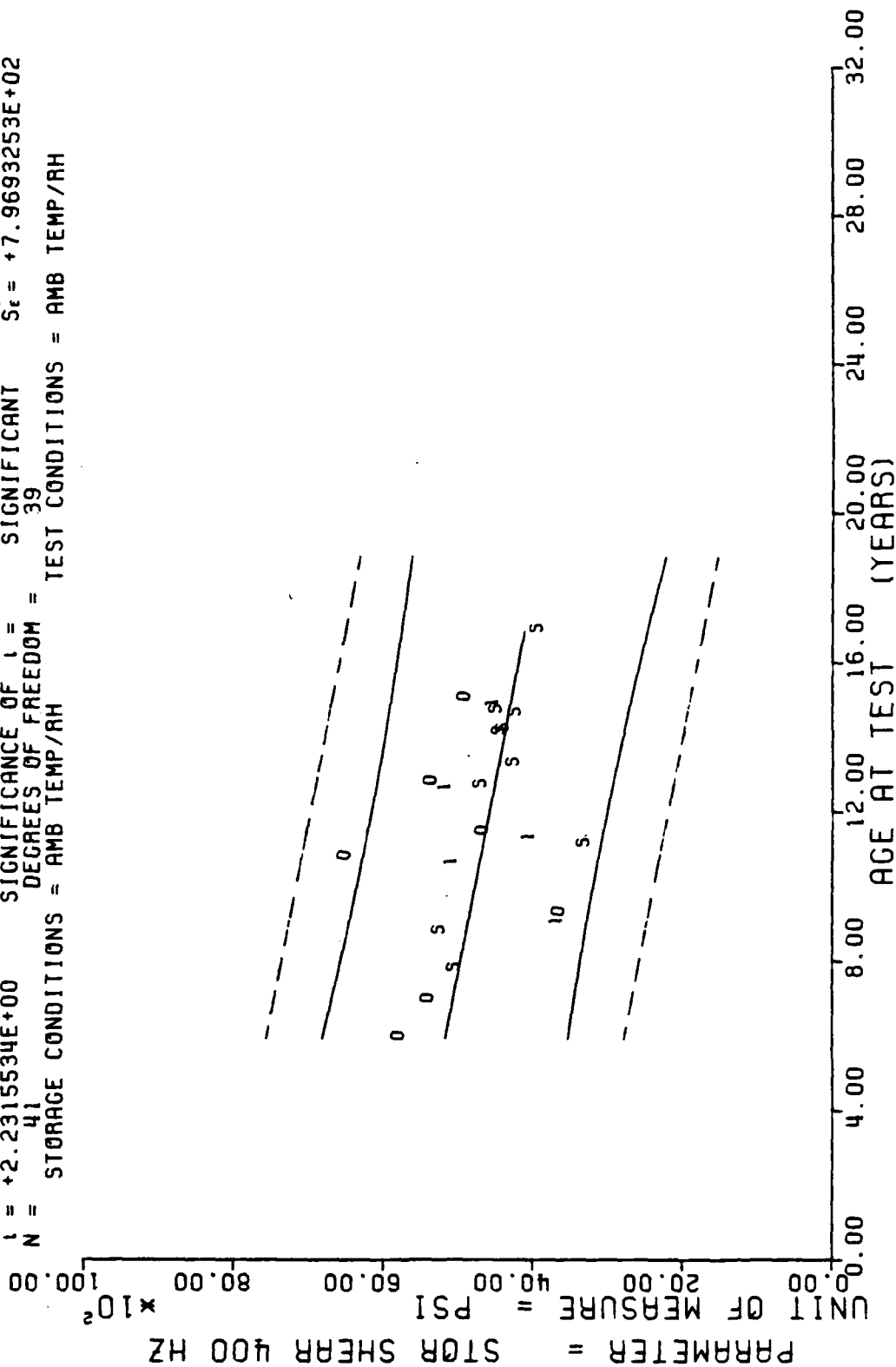
$Y = ((+4.8408579E+03) + (-7.1612581E+00) * X)$
 SIGNIFICANCE OF F = SIGNIFICANT
 SIGNIFICANCE OF R = SIGNIFICANT
 SIGNIFICANCE OF t = SIGNIFICANT
 DEGREES OF FREEDOM = 39

STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTED MOTORS. DYNAMIC RESPONSE, CENTER-WT 70 GM, STOR SHEAR AT 200 HZ

| | Y | = ((+5.746G319E+03) + (-8.0804903E+00) * X) | | |
|---|------------------|---|---------------|-------------------------------|
| F | = +4.9798307E+00 | SIGNIFICANCE OF F | = SIGNIFICANT | σ_f = +8.3563830E+02 |
| R | = -3.3649647E-01 | SIGNIFICANCE OF R | = SIGNIFICANT | S_r = +3.6210158E+00 |
| t | = +2.2315534E+00 | SIGNIFICANCE OF t | = SIGNIFICANT | S_t = +7.9693253E+02 |
| N | = | χ^2_1 DEGREES OF FREEDOM | = 39 | |
| | | STORAGE CONDITIONS = AMB TEMP/RH | | TEST CONDITIONS = AMB TEMP/RH |



STAGE 1 DISSECTED MOTORS, DYNAMIC RESPONSE, CENTER-WT 70 GM, STOR SHEAR AT 400 HZ

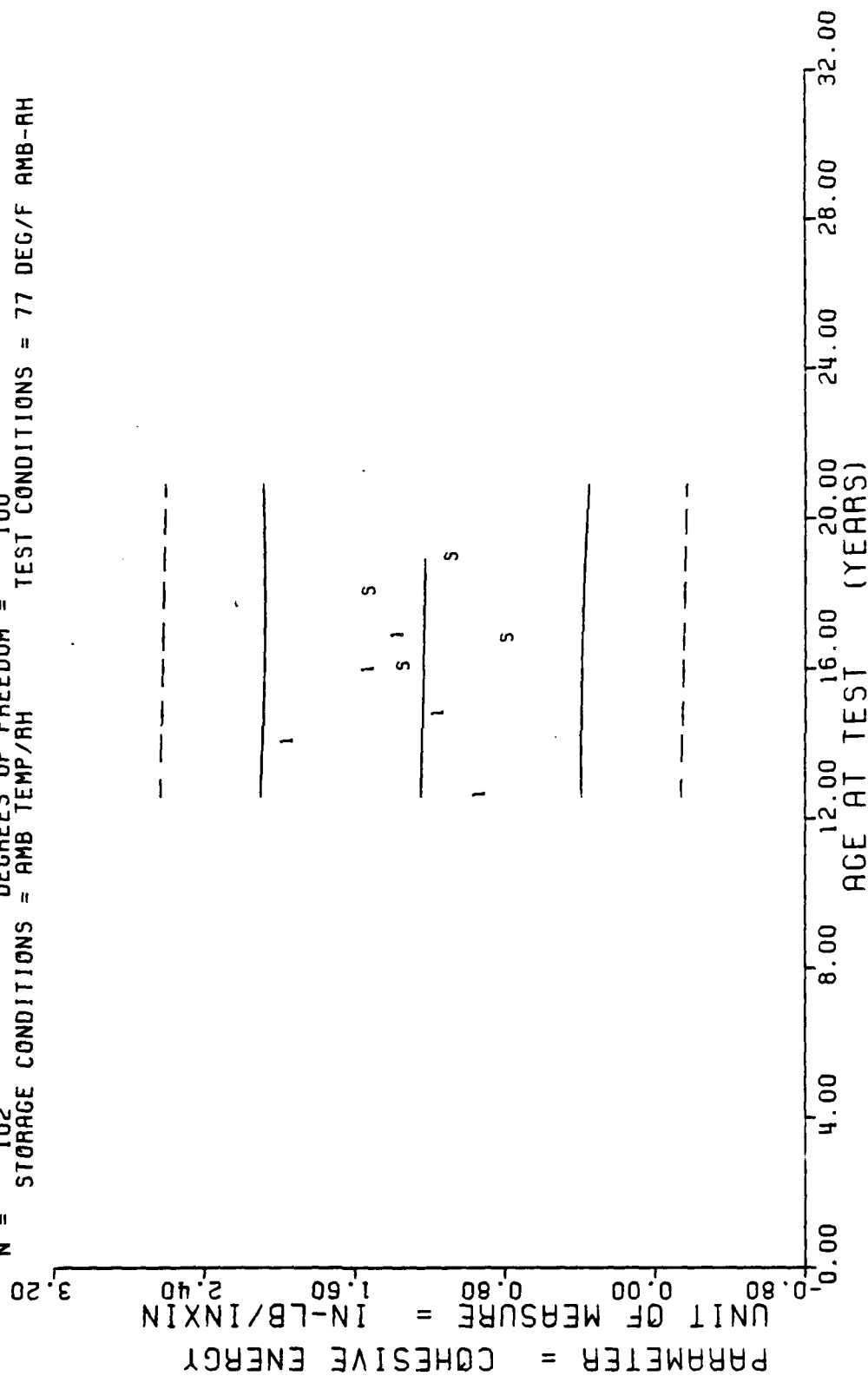
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|
| 151.0 | 12 |
| 168.0 | 11 |
| 177.0 | 8 |
| 191.0 | 0 |
| 192.0 | 11 |
| 201.0 | 9 |
| 202.0 | 10 |
| 216.0 | 9 |
| 227.0 | 12 |

STAGE I DISSECTED MOTORS. TEAR ENERGY TEST/TEMP=77 DEG F

This sample size summary is applicable to figure 44

$Y = ((+1.2918318E+00) + (-3.0759457E-04) \times X)$
 $F = +2.9796631E-02$ SIGNIFICANCE OF F = NOT SIGNIFICANT $S_r = +4.5991832E-01$
 $R = -1.7259129E-02$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_o = +1.7819482E-03$
 $I = +1.7261700E-01$ SIGNIFICANCE OF I = NOT SIGNIFICANT $S_f = +4.6214335E-01$
 $N = 102$ DEGREES OF FREEDOM = 100
 STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = 77 DEG/F AMB-AH



STAGE I DISSECTED MOTORS. TEAR ENERGY TEST/TEMP=77 DEG F

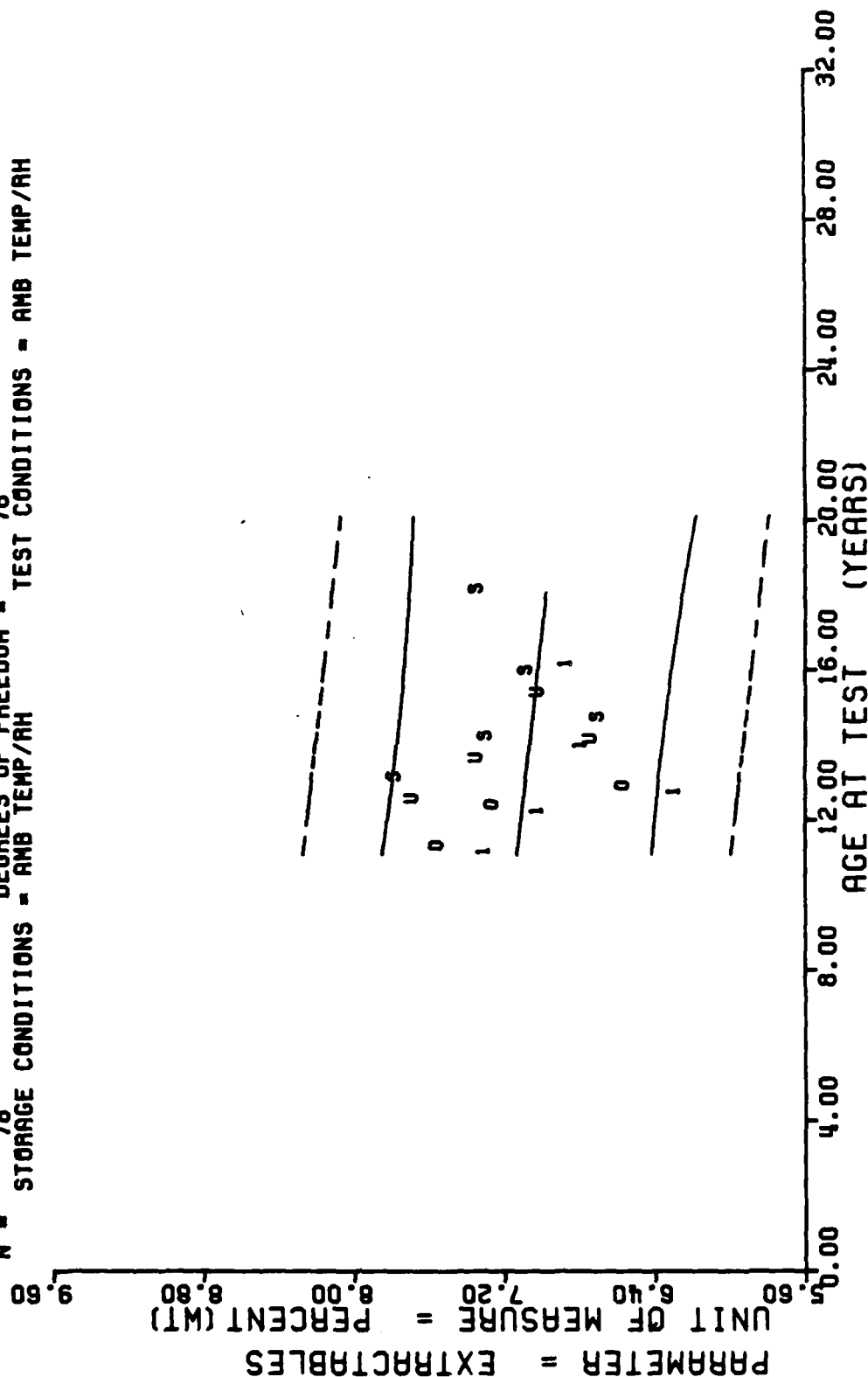
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|
| 133.0 | 4 |
| 135.0 | 4 |
| 146.0 | 4 |
| 148.0 | 4 |
| 150.0 | 4 |
| 152.0 | 4 |
| 154.0 | 4 |
| 157.0 | 4 |
| 163.0 | 4 |
| 167.0 | 6 |
| 169.0 | 4 |
| 170.0 | 4 |
| 176.0 | 4 |
| 184.0 | 6 |
| 191.0 | 6 |
| 193.0 | 6 |
| 217.0 | 6 |

DISSECTED MTR, STAGE 1, TF-H1011, SOL GEL, PERCENT EXTRACTABLES

This sample size summary is applicable to figures 45 thru 48

$Y = ((+7.3834963E+00) + (-1.8846172E-03) * X)$
 $F = +9.7903503E-01$ SIGNIFICANCE OF F = NOT SIGNIFICANT $G_1 = +3.7908613E-01$
 $R = -1.1277501E-01$ SIGNIFICANCE OF R = NOT SIGNIFICANT $S_1 = +1.9046889E-03$
 $t = +9.8946199E-01$ SIGNIFICANCE OF t = NOT SIGNIFICANT $S_2 = +3.7913774E-01$
 $N = 78$ DEGREES OF FREEDOM = 76
 $N =$ STORAGE CONDITIONS = AMB TEMP/AH TEST CONDITIONS = AMB TEMP/AH



DISSECTED MTR, STAGE 1, TP-H1011, SOL GEL, PERCENT EXTRACTABLES

Figure 45

$F = +1.234011E-05$
 $R = -4.0295143E-04$
 $t = +3.5128494E-03$
 $N = 78$

$Y = ((+3.7031595E+00) + (-3.1122920E-06) \times X)$
 SIGNIFICANCE OF F = NOT SIGNIFICANT
 SIGNIFICANCE OF R = NOT SIGNIFICANT
 SIGNIFICANCE OF t = NOT SIGNIFICANT
 DEGREES OF FREEDOM = 76

STORAGE CONDITIONS = AMB TEMP/AH
 TEST CONDITIONS = AMB TEMP/AH

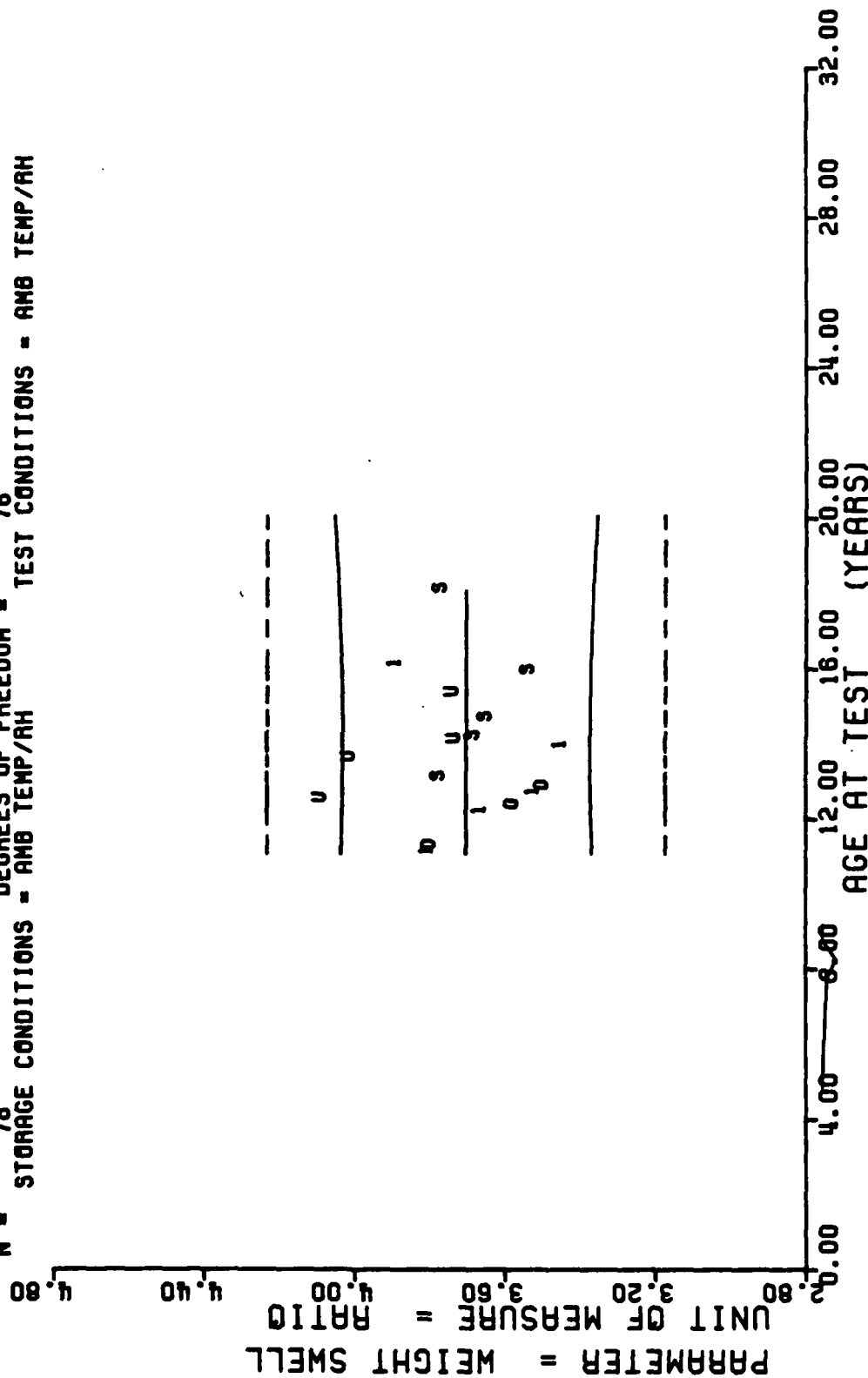
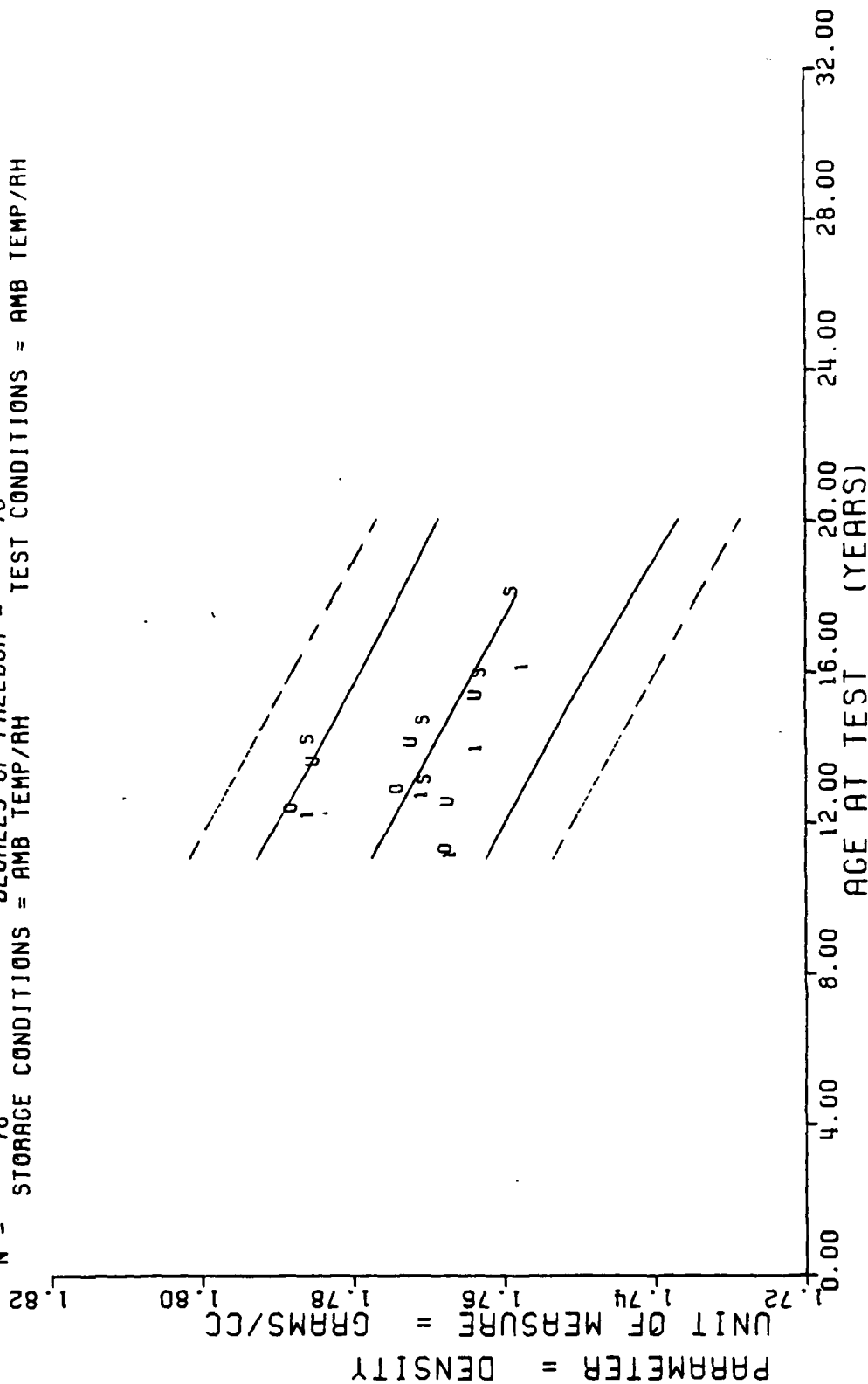


Figure 46

$Y = ((+1.8080676E+00) + (-2.2965368E-04) * X)$
 F = +3.2370641E+01
 R = -5.4653732E-01
 I = +5.6895203E+00
 N = 78
 SIGNIFICANCE OF F = SIGNIFICANT
 SIGNIFICANCE OF R = SIGNIFICANT
 SIGNIFICANCE OF I = SIGNIFICANT
 DEGREES OF FREEDOM = 76
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = AMB TEMP/RH



DISSECTED MTR, STAGE 1, TP-H1011, SOL GEL, DENSITY

$Y = ((+1.3899121E-02) + (-2.0379311E-05) \times X)$
 $F = +6.2429841E+00$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_f = +1.6779168E-03$
 $R = -2.7551591E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_r = +8.1563036E-08$
 $t = +2.4985964E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_t = +1.6235525E-03$
 $N = 76$ DEGREES OF FREEDOM = 76
 $N = 78$ STORAGE CONDITIONS = AMB TEMP/AM TEST CONDITIONS = AMB TEMP/AM

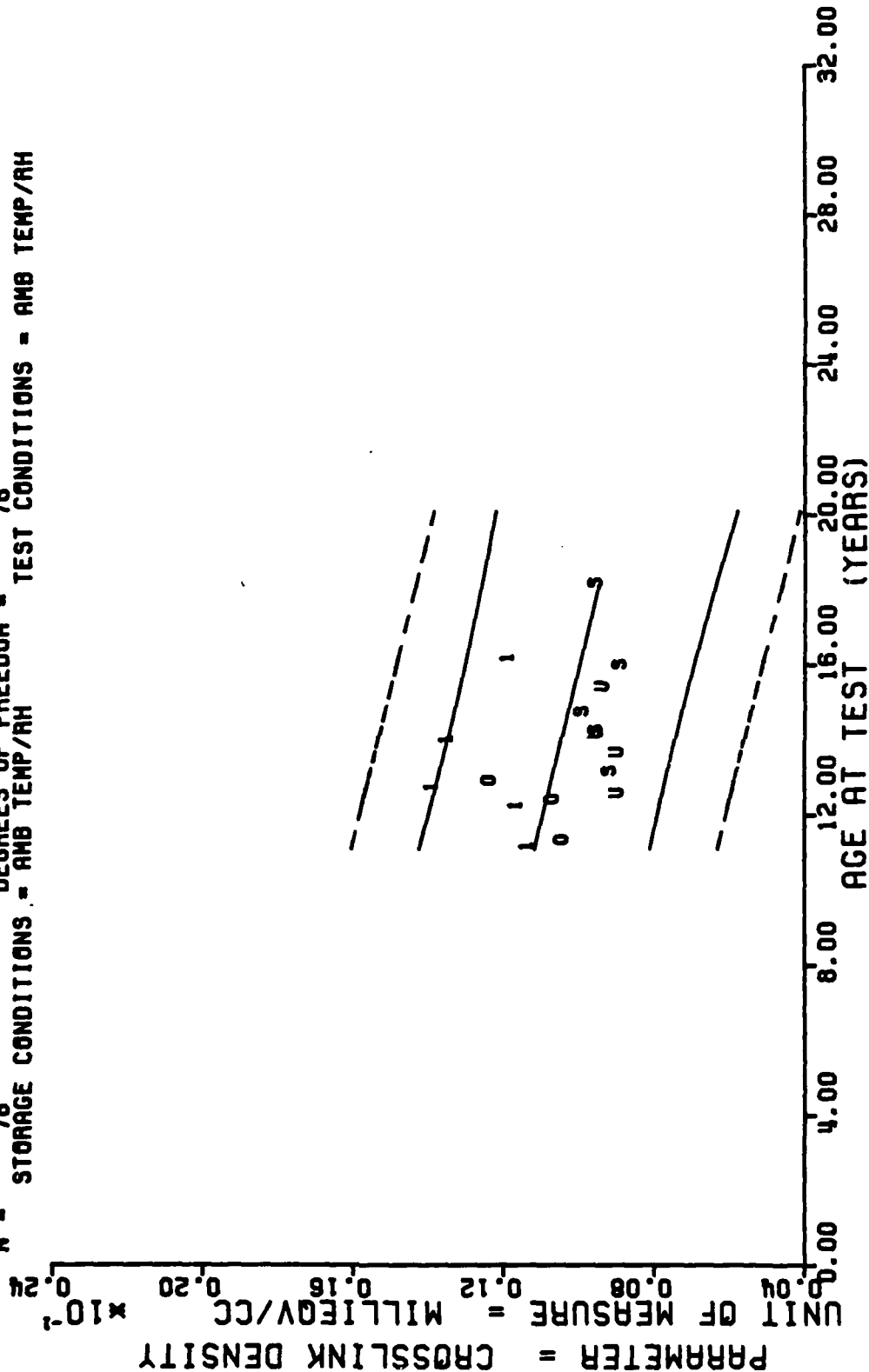


Figure 48

*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 74.0 | 18 | 204.0 | 6 |
| 83.0 | 6 | 216.0 | 3 |
| 89.0 | 6 | 227.0 | 6 |
| 97.0 | 6 | | |
| 98.0 | 6 | | |
| 105.0 | 6 | | |
| 106.0 | 5 | | |
| 108.0 | 5 | | |
| 118.0 | 5 | | |
| 120.0 | 5 | | |
| 123.0 | 5 | | |
| 135.0 | 5 | | |
| 142.0 | 5 | | |
| 152.0 | 6 | | |
| 154.0 | 6 | | |
| 168.0 | 6 | | |
| 169.0 | 6 | | |
| 170.0 | 6 | | |
| 176.0 | 6 | | |
| 179.0 | 6 | | |
| 181.0 | 6 | | |
| 185.0 | 6 | | |
| 192.0 | 3 | | |
| 193.0 | 6 | | |
| 202.0 | 6 | | |

STAGE 1 DISSECTED MOTORS, BURNING RATE AT 500 PSI INITIAL PRESSURE

This sample size summary is applicable to figure 49

$F = +1.7477424E+01$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_t = +2.1954344E-02$
 $R = -3.0948111E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_0 = +3.5393242E-05$
 $t = +4.1806010E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_t = +2.0939675E-02$
 $N = 167$ DEGREES OF FREEDOM = 165
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH

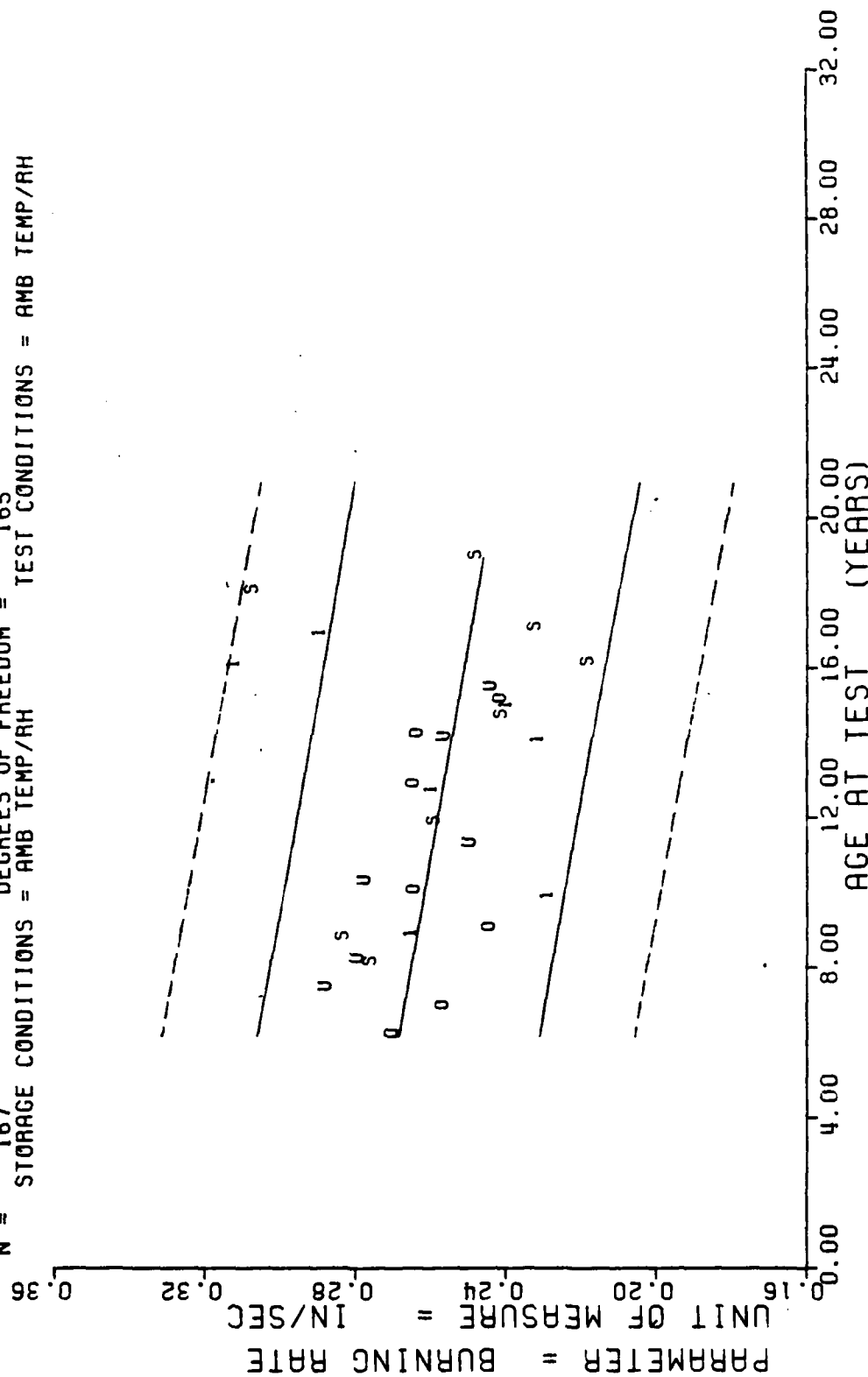


Figure 49

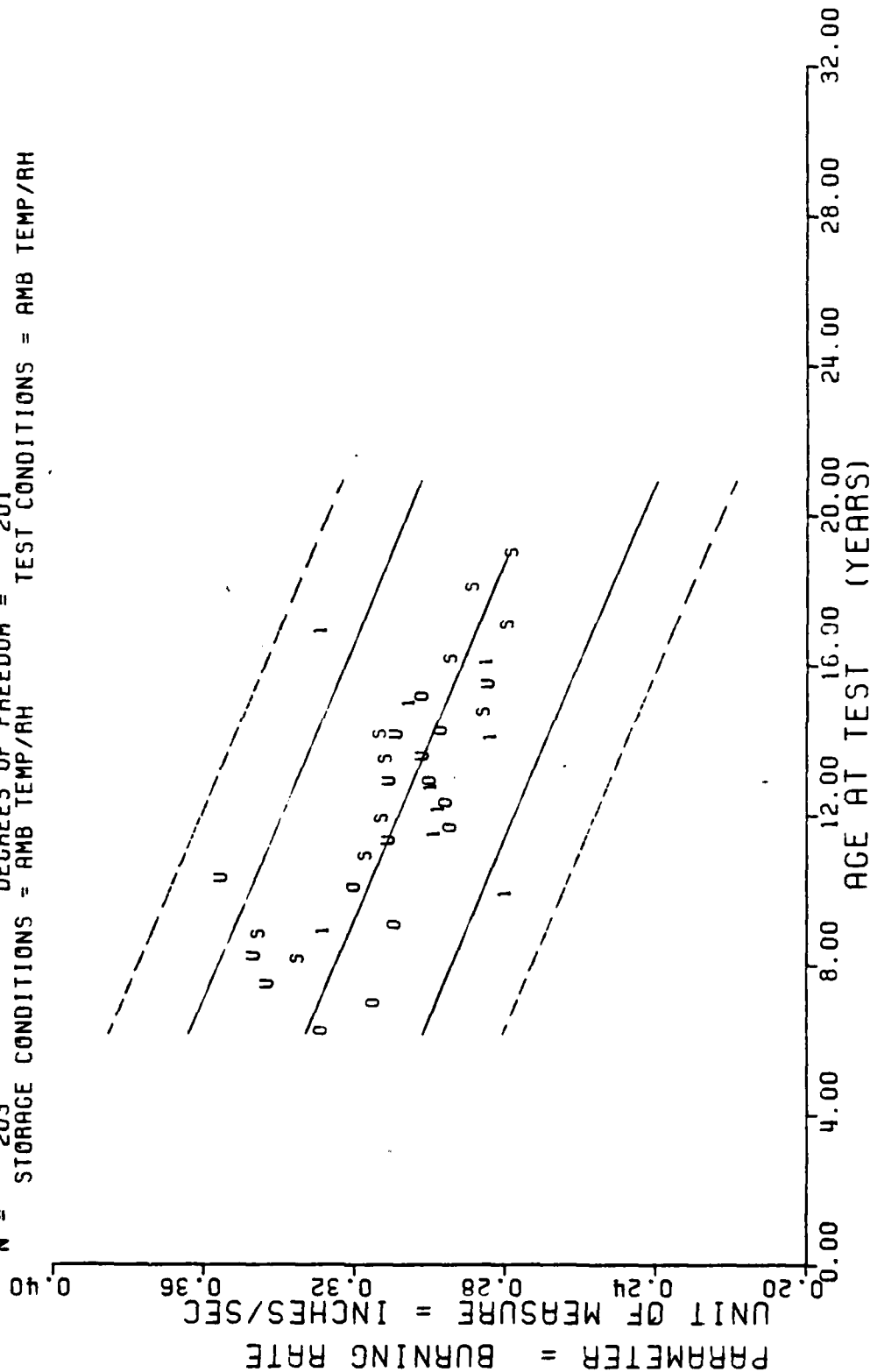
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 74.0 | 6 | 176.0 | 6 |
| 83.0 | 6 | 179.0 | 6 |
| 89.0 | 6 | 181.0 | 6 |
| 97.0 | 6 | 185.0 | 6 |
| 98.0 | 6 | 192.0 | 3 |
| 105.0 | 6 | 193.0 | 6 |
| 106.0 | 5 | 202.0 | 6 |
| 108.0 | 5 | 204.0 | 6 |
| 116.0 | 5 | 216.0 | 3 |
| 120.0 | 5 | 227.0 | 6 |
| 123.0 | 5 | | |
| 130.0 | 5 | | |
| 135.0 | 5 | | |
| 137.0 | 8 | | |
| 139.0 | 5 | | |
| 142.0 | 5 | | |
| 145.0 | 6 | | |
| 147.0 | 5 | | |
| 152.0 | 5 | | |
| 154.0 | 11 | | |
| 161.0 | 5 | | |
| 162.0 | 5 | | |
| 168.0 | 6 | | |
| 169.0 | 11 | | |
| 170.0 | 6 | | |

STAGE 1 DISSECTED MOTORS. BURNING RATE AT 1000 PSI INITIAL PRESSURE

This sample size summary is applicable to figure 50

$F = +1.1926894E+02$
 $R = -6.1024786E-01$
 $I = +1.0921032E+01$
 $N = 203$
 $Y = ((+3.5895544E-01) + (-3.4983541E-04) * X)$
 SIGNIFICANCE OF F = SIGNIFICANT
 SIGNIFICANCE OF R = SIGNIFICANT
 SIGNIFICANCE OF I = SIGNIFICANT
 DEGREES OF FREEDOM = 201
 STORAGE CONDITIONS = AMB TEMP/RH
 TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTED MOTORS, BURNING RATE AT 1000 PSI INITIAL PRESSURE

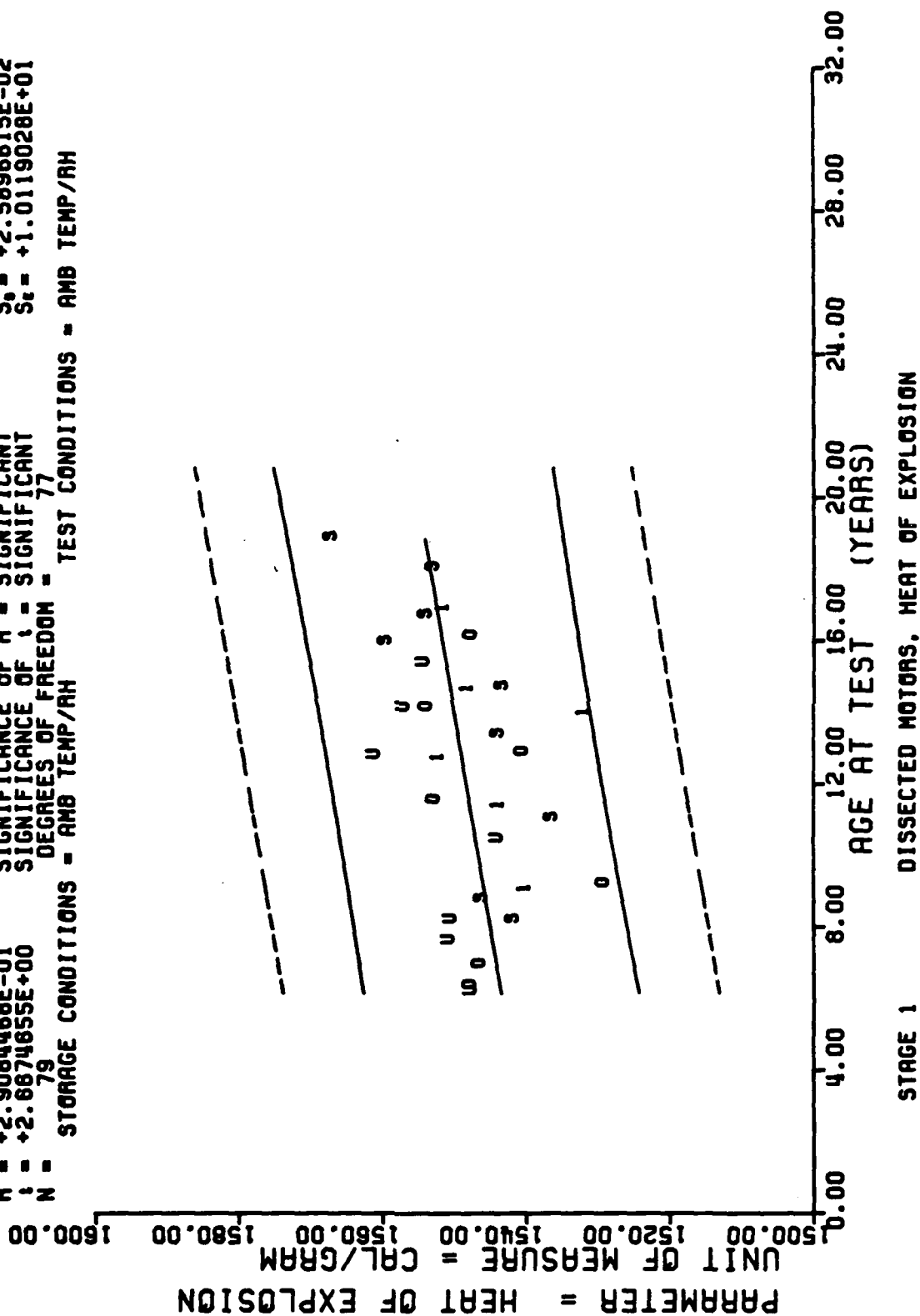
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES | AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|-----------------|---------------|
| 74.0 | 3 | 216.0 | 3 |
| 76.0 | 3 | 226.0 | 3 |
| 83.0 | 3 | | |
| 91.0 | 3 | | |
| 98.0 | 6 | | |
| 105.0 | 3 | | |
| 108.0 | 1 | | |
| 110.0 | 1 | | |
| 125.0 | 1 | | |
| 132.0 | 1 | | |
| 136.0 | 3 | | |
| 138.0 | 3 | | |
| 152.0 | 3 | | |
| 153.0 | 2 | | |
| 154.0 | 3 | | |
| 160.0 | 3 | | |
| 167.0 | 3 | | |
| 169.0 | 6 | | |
| 175.0 | 3 | | |
| 176.0 | 3 | | |
| 184.0 | 3 | | |
| 191.0 | 3 | | |
| 193.0 | 3 | | |
| 200.0 | 3 | | |
| 202.0 | 3 | | |

STAGE 1 DISSECTED MOTORS. HEAT OF EXPLOSION

This sample size summary is applicable to figure 51

| | | | | | | | | | | | | |
|---|---|----------------|---|---|--------------------|---|------------------|---|------|---|---|----------------|
| F | = | +7.1153723E+00 | Y | = | ((+1.5383948E+03) | + | (+6.9076329E-02) |) | * X) | G | = | +1.0508221E+01 |
| R | = | +2.9084468E-01 | | | SIGNIFICANCE OF F | = | SIGNIFICANT | | | S | = | +2.5896615E-02 |
| t | = | +2.6874855E+00 | | | SIGNIFICANCE OF A | = | SIGNIFICANT | | | S | = | +1.0119028E+01 |
| N | = | | | | SIGNIFICANCE OF t | = | SIGNIFICANT | | | | | |
| | | | | | DEGREES OF FREEDOM | = | 77 | | | | | |
| | | | | | STORAGE CONDITIONS | = | AMB TEMP/AH | | | | | |
| | | | | | TEST CONDITIONS | = | AMB TEMP/AH | | | | | |



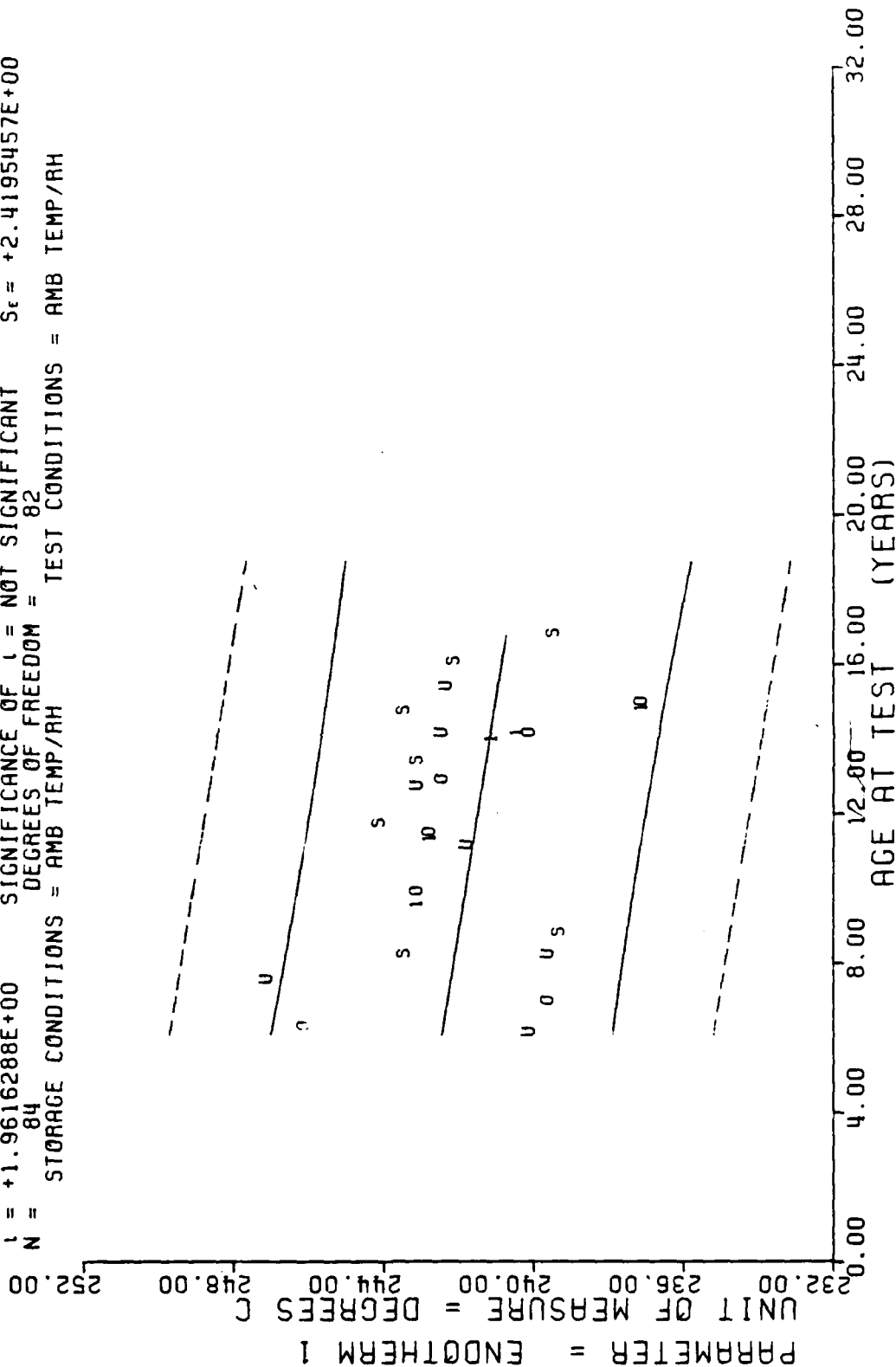
*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|
| 73.0 | 4 |
| 75.0 | 3 |
| 83.0 | 2 |
| 90.0 | 3 |
| 98.0 | 9 |
| 105.0 | 5 |
| 114.0 | 3 |
| 118.0 | 3 |
| 133.0 | 3 |
| 135.0 | 3 |
| 137.0 | 3 |
| 140.0 | 3 |
| 152.0 | 2 |
| 154.0 | 3 |
| 160.0 | 3 |
| 167.0 | 3 |
| 169.0 | 9 |
| 176.0 | 3 |
| 177.0 | 3 |
| 179.0 | 3 |
| 184.0 | 5 |
| 192.0 | 3 |
| 201.0 | 3 |

STAGE 1 DISSECTED MOTORS, OIA, ENDOTHERM 1, 12 DEGREE C RISE/MINUTE

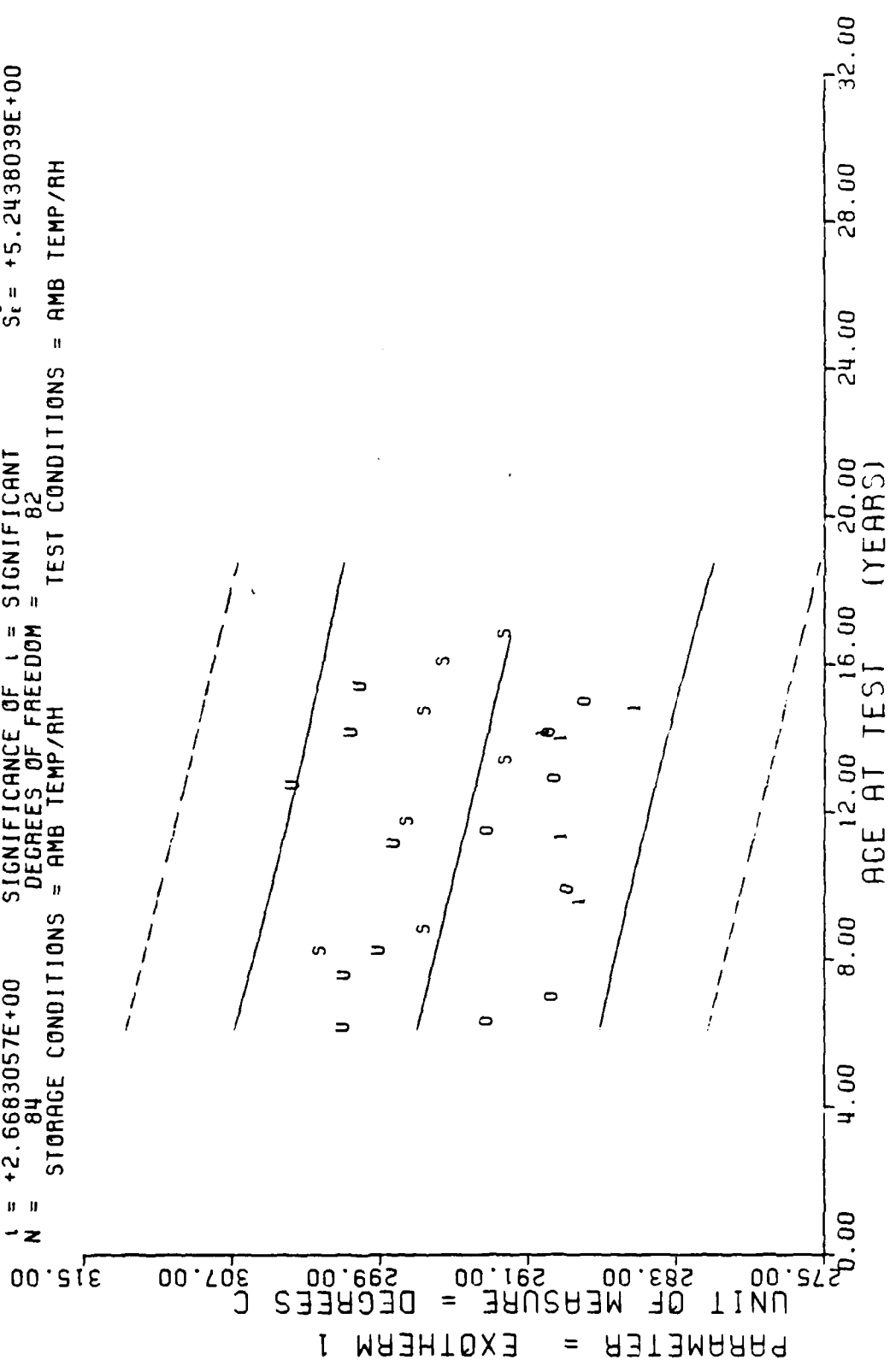
This sample size summary is applicable to figures 52 and 53

$F = +3.8479877E+00$ SIGNIFICANCE OF $F = (-1.3501864E-02) \times X$
 $R = -2.1171507E-01$ SIGNIFICANCE OF $R =$ NOT SIGNIFICANT
 $t = +1.9616288E+00$ SIGNIFICANCE OF $t =$ NOT SIGNIFICANT
 $N = 84$ DEGREES OF FREEDOM = 82
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTED MOTORS, DTA, ENDOTHERM 1, 12 DEGREE C RISE/MINUTE

$F = +7.1198556E+00$ SIGNIFICANCE OF F = SIGNIFICANT $\sigma_1 = +5.4336872E+00$
 $R = -2.8264958E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S_0 = +1.4917275E-02$
 $t = +2.6683057E+00$ SIGNIFICANCE OF t = SIGNIFICANT $S_t = +5.2438039E+00$
 $N = 84$ DEGREES OF FREEDOM = 82
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTED MOTORS, DTA, EXOTHERM 1, 12 DEGREE C RISE/MINUTE

*** SAMPLE SIZE SUMMARY ***

| AGE (MONTHS) | NR SAMPLES |
|-----------------|---------------|
| 73.0 | 4 |
| 75.0 | 3 |
| 83.0 | 2 |
| 90.0 | 3 |
| 98.0 | 9 |
| 105.0 | 5 |
| 114.0 | 2 |
| 133.0 | 3 |
| 135.0 | 2 |
| 140.0 | 3 |
| 152.0 | 2 |
| 154.0 | 1 |
| 167.0 | 2 |
| 169.0 | 6 |
| 176.0 | 2 |
| 177.0 | 3 |
| 179.0 | 2 |
| 184.0 | 5 |
| 192.0 | 3 |
| 201.0 | 3 |

STAGE 1 DISSECTED MOTORS. DTA IGNITION TEMP, 12 DEG C RISE/MINUTE

This sample size summary is applicable to figure 54

AD-A098 409 OGDEN AIR LOGISTICS CENTER HILL AFB UT PROPELLANT AN--ETC F/G 21/9.2
SURVEILLANCE REPORT, STAGE I DISSECTED MOTORS, PHASE XII, PROPE--ETC(U)
JAN 81 J A THOMPSON

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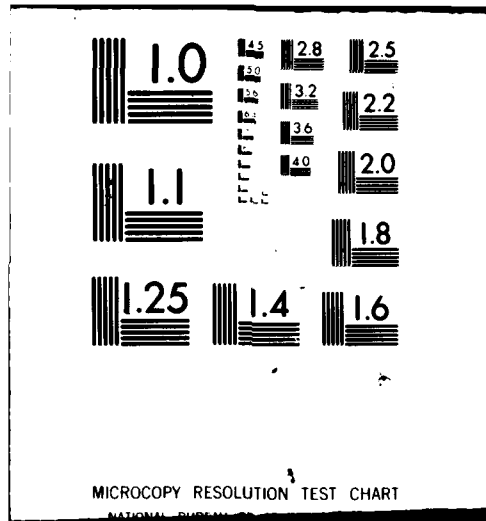
END

DATE

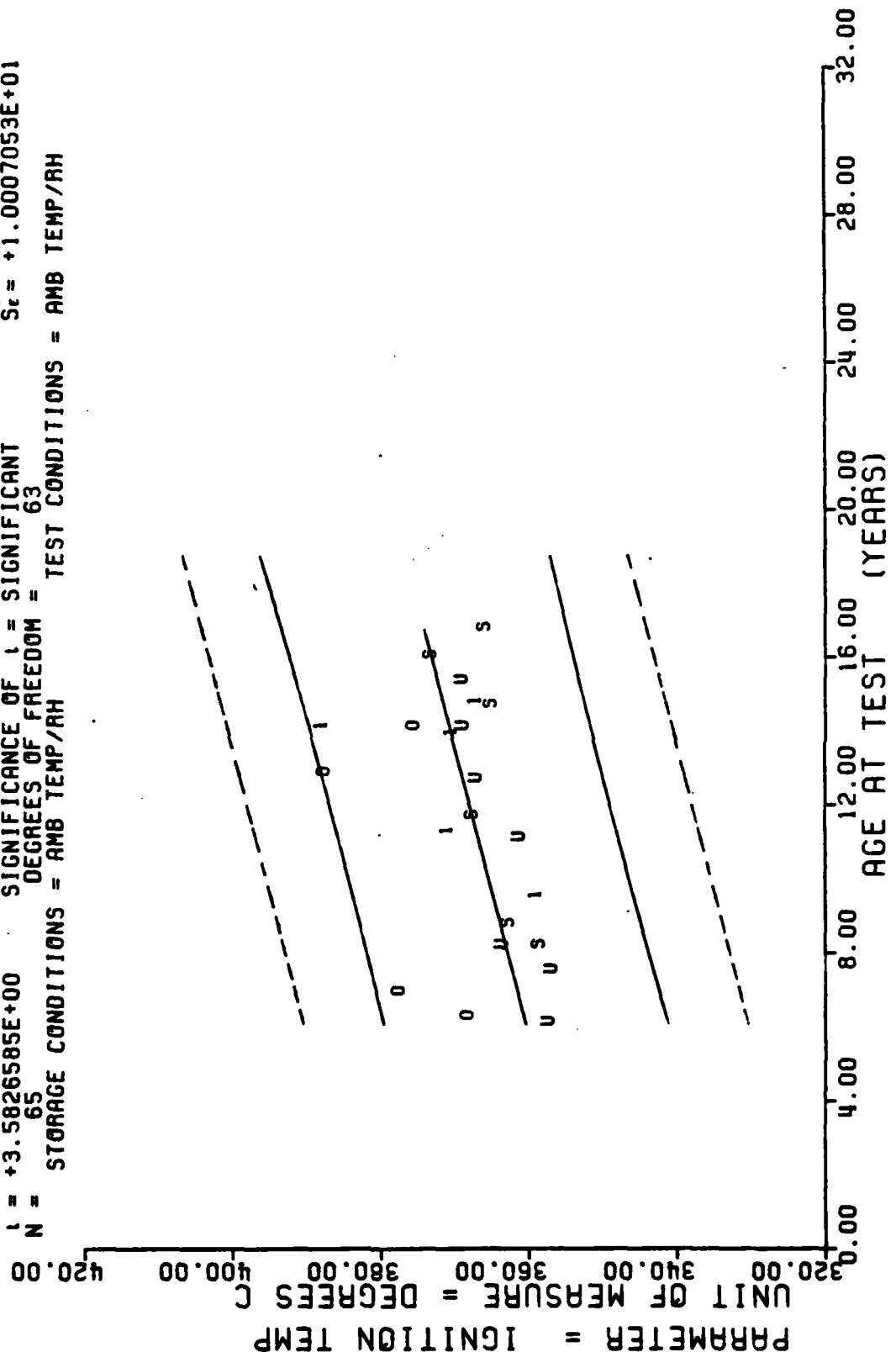
FILED

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DTIC



$Y = ((+3.5261042E+02) + (+1.0680296E-01) * X)$
 $F = +1.2835442E+01$ SIGNIFICANCE OF F = SIGNIFICANT $G = +1.0893121E+01$
 $R = +4.1140475E-01$ SIGNIFICANCE OF R = SIGNIFICANT $S = +2.9811091E-02$
 $I = +3.5826585E+00$ SIGNIFICANCE OF I = SIGNIFICANT $Sr = +1.0007053E+01$
 $N = 65$ DEGREES OF FREEDOM = 63
 STORAGE CONDITIONS = AMB TEMP/RH TEST CONDITIONS = AMB TEMP/RH



STAGE 1 DISSECTIONED MOTORS, DTA IGNITION TEMP, 12 DEG C RISE/MINUTE

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| 18. SUPPLEMENTARY NOTES | | |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Minuteman Solid Propellant | | |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Testing was performed to determine the useful shelf/service life for LGM-30 Stage I Rocket Motors. A three year storage program for propellant and components was started in May 1961. This program was then extended to a ten year study and later continued indefinitely to assure that a deterioration in motor physical characteristics could be detected in time to take some corrective actions before the weapon system performance deteriorated below an acceptable level. | | |

This report covers only propellant data and limited case bond data. The malfunction of an environmental chamber destroyed component samples that had originally been part of this testing program (and the inadvertent burning of some motors during dissection reduced the material available for testing). Planned dissection of selected motors in the future will provide samples for continued component testing. Test specimens for this reporting period were obtained from motors STM-012, 0012099, and 012199. Up-7775 block propellant was not tested since the propellant has been used up.

Separate analyses were made on the respective motors and block propellant for the second time in this report and are shown in the regressions. The plotting symbols for each motor and block propellant are listed in the statistical analyses section.

The data from this test period was combined with data from previous testing and entered into the GOS computer for storage, analysis, and regression analysis. From the statistical analysis of all data tested to date, significant degradation of the propellant does not appear likely for at least two years past the oldest data point.

Future testing will be conducted on dissected motors.

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